THE

GARDENS' BULLETIN

SINGAPORE

Vol. XIII 30th June 1950 Part 1

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To be purchased at the Botanic Gardens, Singapore
Price $10

Published by Authority

PRINTED AT THE GOVERNMENT PRINTING OFFICE, SINGAPORE,
BY V. C. G. GATRELL, GOVERNMENT PRINTER

1950

1 AUG 1950

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THE ZINGIBERACEAE OF THE MALAY PENINSULA

By R. E. HOLTTUM

The only recent critical morphological studies of plants in this family are those by Valeton. Unfortunately they cover only a limited part of the whole field, but their thoroughness and clarity of presentation showed the way for further progress. The present work was begun by an examination of living plants of those genera studied by Valeton, and his work is therefore the basis of that now presented. In addition to living plants of species of almost all genera, alcohol material of many other species was available for study, mostly collected during the years 1930–1940 by Mr. E. J. H. Corner, with copious field notes, the substance of which is included in the present descriptions. In addition, there are careful coloured drawings of several species described by Mr. Ridley, which have supplied some information not otherwise available. Of some species, however, only dried specimens have been examined, and there are accordingly gaps in necessary information about them.

The species descriptions here presented are rather lengthy, but I believe that this is necessary in the present inadequate state of our knowledge of the family. It has been my experience that earlier descriptions frequently omitted data which appeared to me necessary for a proper characterization of the species. For the purpose merely of identifying the species now known to exist in Malaya, much briefer descriptions would be adequate; but they would not be helpful in the understanding of species still to be discovered, either in this country or in neighbouring territories. I have attempted also a comparative account of the morphology of the inflorescence, which appears to me of basic importance.

The present work is confined to species in the Malay Peninsula for two reasons. First, it was mainly prepared in the year 1944, when I had adequate material only of such species for study; and second, I have now other work on hand which prevents me attempting a study of the family over a wider area. Though the work is therefore of necessity a partial one, and though in consequence I cannot offer a satisfactory solution of such problems as that of the typification of Alpinia, I hope that the present work will be a useful basis for that wider study of this interesting family in Malaysia as a whole which is so desirable.

Summary of characters. *Rhizome* usually fleshy, sympodial, each element of the sympodium ending in an erect leaf-bearing shoot, or sometimes in a flowering shoot only; horizontal part of rhizome bearing distichous scale-leaves. *Leaf-shoots* short or tall (to about 5 m. or more), bearing one to many distichous or spirally arranged leaves; if many, the main part of the stem usually formed by the overlapping leaf-sheaths, the true axis being often slender and composed mainly of thin-walled cells. *Leaves* varying much in size, usually elliptic to elliptic-oblong, asymmetric or not, with or without a petiole between blade and sheath; sheath tubular towards the base only or throughout; ligule usually well-developed. *Inflorescence* terminal on the leafy shoot or on a separate shoot from the base of the leafy shoot or from the rhizome; flowers arranged in cincinni in the axils of primary bracts, or solitary in the axils of primary bracts, with or without secondary bracts; an involucre of sterile bracts sometimes present. *Flowers* usually lasting one day, or less. *Calyx* tubular, usually 3-toothed, often split rather deeply down one side only. *Corolla-tube* usually slender, often longer than the calyx, sometimes widened distally, bearing 3 lobes; lobes sub-equal or more often the dorsal one larger than the lateral ones; dorsal lobe always overlapping the others in bud, its apex sometimes hollow, hooded or spurred (e.g. Alpinia, Globba). *Labellum* adnate to the corolla-tube, usually, but not always the largest floral organ, entire, more or less deeply bilobed, or somewhat trilobed (never deeply trilobed except in Zingiber, in which the lateral lobes are formed by the adnate staminodes). Two *staminodes* of the outer whorl, on either side of the dorsal corolla lobe, nearly always present as petaloid structures adnate to the corolla-tube, or as rudimentary teeth; in Zingiber joined to the labellum at the base; in Geocharis joined to the filament except for their free apices; in Costus apparently quite united to the labellum so as to show no individual existence. One *stamen* of the inner

whorl, on the same radius as the dorsal corolla-lobe, fertile; *filament* joined to the flower tube at the base, sometimes joined to the labellum or the staminodes above the insertion of the corolla lobes, short or long, broad or narrow; *anther* with dorsal connective which may be laterally extended into a lamina or into appendages, and/or apically into a small or large fleshy or petaloid crest; *pollen-sacs* usually dehiscing longitudinally but sometimes by apical pores, sometimes with adnate or free sterile basal extensions or spurs. *Style* slender, passing upwards close to the filament and between the pollen-sacs, by the growth of which it is held in position, bearing the stigma just beyond the apex of the pollen-sacs. *Stigma* usually swollen with an elliptic aperture fringed by hairs. *Ovary* inferior, unilocular with parietal placentation, or trilocular with axile placentation or with ovules joined to the septa, or unilocular with placenta basal or erect from the base. *Nectar-glands* (stylodes) either erect outgrowths within the base of the flower-tube, on either side of the style, or in Costus interseptal glands connected to the base of the flower-tube by two cavities. *Fruit* a dehiscent capsule or a fleshy berry, or indehiscent with wall of varying thickness, breaking irregularly when old. *Seeds* always with an aril; aril sometimes covering the seed entirely or more or less lacerate, or a basal cushion only; perisperm sometimes (always?) present as well as endorsperm.

Rhizome. The rhizome is usually at or just below the surface of the ground. In some genera (e.g. Achasma) it is often more deeply buried; in others (especially in Hornstedtia and Geostachys) it is supported above the ground on stout unbranched stilt-roots which may in some cases be very long. In some species of Scaphochlamys it ascends obliquely or even almost vertically, usually in places where there is a litter of dead leaves of some thickness, and is supported on more slender stilt-roots.

The rhizome is always sympodial, every branch of it ending (potentially at least) in an erect shoot which bears leaves or flowers, or both. The rhizome is renewed by a bud from the axil of a scale-leaf near the base of the erect shoot. The rhizome thus consists of a series of separate parts, each beginning as a bud at the base of an erect shoot and ending in a similar erect shoot; these parts we will call *rhizome-elements*. They may be short or long, stout or thin, according to the nature of the species concerned.

In many plants of other families such a rhizome functions as a resting organ, persisting below ground during seasons unfavourable for growth, while the leafy shoots wither. In the climate of Malaya however (except to some

extent in the extreme north) there is no such unfavourable season; growth is possible at almost all times of the year, though it may occur mainly at the wetter periods, and there is no time when the plant cannot maintain its leaf-shoots. Thus the rhizome does not serve as a resting organ in the great majority of Malayan Zingiberaceae; and Zingiberaceae as a family are largely confined to regions of the world with a warm and relatively uniform climate. There are however some exceptions, chiefly in the genera Kaempferia, Curcuma and Zingiber; in such cases the rhizome is fleshy and adapted as a resting organ. In Curcuma especially, it produces a repeatedly branched mass, such as never occurs in our native Malayan forest plants. Species with such resting rhizomes are usually adapted to a seasonal climate, and their flowering comes at a definite stage in the life-cycle. Some of them (such as the common Turmeric, *Curcuma domestica*) can tolerate the uniform climate of Singapore and respond to it by growing continuously; flowering of such species is here erratic and in some cases rare. But by this adaptation to a regular seasonal resting period, such species have been enabled to invade countries beyond the uniformly moist and warm climatic regions, and have also in many cases left the shelter of the forest (in which alone most Malayan species can live) and entered more open country. There are however no true xerophytes in the family.

Leaf-shoots. The characteristic leaf-shoot of the family is erect with the apex curving over slightly, about 1–5 m. tall, and unbranched; branched leaf-shoots occur only in Costus. In the Hedychium tribe there are several genera (Kaempferia, Scaphochlamys etc.) which have quite short leaf-shoots; these are discussed further below.

In Alpinia and allied genera with tall leaf-shoots, each shoot bears a number of two-ranked leaf blades which spread more or less horizontally. The lowest blades are usually at about one-third of the total height of the shoot; they are shorter and proportionately broader than those higher up. The largest leaves are those rather above the middle of the leaf-bearing part. The apical leaves in genera like Phaeomeria, which have no terminal inflorescence, are again smaller and also proportionately narrow; in Alpinia and allied genera, in which the inflorescence is terminal, there are fewer small apical leaves. In all leaf-shoots of this habit there is a short petiole at the base of each leaf; only in Cenolophon is the petiole sometimes rather long.

The petiole, or base of the leaf-blade, is joined to a sheath. At the junction of petiole and sheath is the *ligule*, which is almost always conspicuous; it forms a narrow or

broad lamina passing across the base of the petiole, and sometimes has raised auricles on either side. In some cases (e.g. *Hedychium longicornutum*) the ligule is very long; in others it is short. In plants of the Alpinia habit, it lies close against the sheath of the leaf next above.

The *sheaths* of the Alpinia type of shoot are long and fit closely one inside the other. They are tubular near the base only, the edges being separated by a narrow gap for part of their length. In Phaeomeria, with leaf shoots about 4 m. tall, the sheaths of the largest leaves are more than 2 m. long. The basal part of the shoot, which bears no leaf-blades, is covered with a succession of bladeless sheaths, which often bear subapical rudimentary blades, their rounded apices representing their ligules.

Such leaf-shoots which do not bear terminal inflorescences are often termed *false-stems*, the idea being that they consist only of a series of concentric leaf-sheaths, the inner sheaths being longer and larger, no true stem being present. This condition is found in a young banana shoot which is not yet flowering; but in all Zingiberaceae of the Alpinia or Phaeomeria habit a true central stem is present. In the case of flowering shoots of Alpinia, the stem obviously reaches the apex of the shoot; in fully grown shoots of Phaeomeria it reaches at least three-quarters of the total height of the shoot. The stem is however formed entirely of soft tissue and has no part in the mechanical support of the shoot, which is provided by the leaf-sheaths. The basal internodes of the stem are rather short, becoming progressively longer upwards. In Phaeomeria the few small apical leaves, which add only a short additional height to the shoot, are attached at rather long intervals on the stem. If a shoot is examined in which these last leaves are not yet developed, the stem may be found to be only half the total height of the shoot.

In Alpinia and allied genera (Catimbium etc.) some species at least show a seasonal flowering. The leaf-shoots grow almost to their full height, but the stem-apex with the inflorescence is still some distance down, hidden by the leaf-sheaths. There it develops until all parts are formed, and apparently it waits for some climatic stimulus to start it on its final stage of growth and flowering. Judging by the behaviour of *Catimbium muticum* in Singapore, the stimulus seems to be wet weather following a dry period.

In Costus there are four differences from the Alpinia-type of leaf-shoot; (1) the leaves are spirally arranged; (2) the sheaths are tubular to the apex; (3) the leaves are (often at least) articulate to the top of the sheaths and are deciduous, as in the majority of orchids; (4) the shoot is

usually branched. The ligule in Costus is a ring (usually narrow) which passes right round the shoot.

In the short-stemmed genera Kaempferia and its allies, the essential structure of the leaf-shoot is exactly as in Alpinia or Phaeomeria, but the stem proper is very short, the leaves few on each shoot, their blades often more or less erect instead of horizontal, and their petioles longer. In all cases there are bladeless sheaths protecting the base of the shoot and enclosing the sheaths of the true leaves (which are sometimes reduced to one on each shoot). In all cases where there is more than one leaf, there is a gradation in size and shape and usually in length of petiole from the lower (or outer) to the upper (or inner) leaves.

Leaves. The relation of the leaves to the leaf-bearing stem is described above. In texture the leaf-blades are usually thin or fairly thin, sometimes slightly fleshy or slightly tough, but never thickly fleshy nor coriaceous. They are often slightly hairy but never densely so. In size they vary much in different genera, some being quite large (to about a metre long); they are never less than a few centimetres long. Some are flushed with purple or otherwise coloured, in whole or in part. In shape they are more or less elliptic, rarely if ever as wide as long, and rarely cordate at the base; they are often asymmetric in the Kaempferia group, the lamina on the two sides of the midrib being of unequal width; in the Alpinia group the asymmetry is most obviously seen in an unequal base to the lamina.

As noted above, the leaves on a single leaf-shoot are not uniform in size. In describing the various species, one should ideally give the usual range of size on a single shoot; but this in practice is rarely possible, as the material is not available. The size actually given in the descriptions in this paper is that of the largest leaf on a shoot, this being the most convenient for comparative purposes. In his detailed study of Curcuma (Bull. Btzg. 2nd Ser. no. XXVII), Valeton gives the sizes of several leaves on a single shoot.

The Inflorescence. The inflorescence is always terminal, either on a leaf-shoot or on a separate shoot (usually from near the base of a leaf-shoot) and usually erect, though in some cases it is more or less decurved or even prostrate. It consists essentially of an axis bearing primary bracts spirally arranged, with a short cincinnus in the axil of each primary bract, this cincinnus being sometimes reduced to a single flower. Only in Plagiostachys, Languas and Alpinia (in the sense of the present paper) are there branches of rank equal to the main axis of the inflorescence, such branches bearing primary bracts with axillary cincinni.

It seems fairly clear that a similar type of inflorescence, variously branched and with the ultimate branch-systems cymose, is primitive in the Liliiflorae; and it is evident that the Scitamineae arose from a Liliiflorous stock. Therefore one may reasonably assume that the form of inflorescence with developed cincinni is primitive in the Zingiberaceae, and that the genera with single flowers in the primary bracts are derivative. On this basis we may classify the genera according to the particular modifications of the inflorescence which they show, having regard not only to reduction of the cincinni but to modifications of the bracts. Such a classification is found to give a very natural grouping, and provides a much more satisfactory basis for a subdivision of the family than floral characters, most of which are variable within single genera. Unfortunately the full details of bracts and bracteoles are usually omitted from the older descriptions of species and genera, even down to the descriptions of Schumann himself. In the present paper full details of this nature are given so far as available in the material in the Singapore Herbarium or Gardens, and the genera in some cases are re-defined accordingly. But it is in many cases impossible to be sure to which genera, as so defined, the species described by Schumann belong.

Primary and Secondary Bracts. Schumann uses the term *primary bracts* for the main bracts of the inflorescence, and this term is similarly used here. In the axil of each primary bract of such a genus as Alpinia is a cincinnus. Each flower on the cincinnus is terminal, and the next branch is axillary, in the axil of a bract placed below the said terminal flower. Thus all bracts subsequent to the primary bracts subtend branches of the cincinnus, not individual flowers, and all are of equal status. Such bracts may be called *secondary bracts*, but it is more usual and more convenient to call them *bracteoles*. In some cases the cincinnus has been reduced to one flower; then the secondary bract (if any) accompanying that flower must represent one of the cincinnus-bracts, and though we may call it a bracteole we must not forget its status as a secondary bract.

In a normal cincinnus, the first secondary bract faces at right angles to the primary bract, and subsequent secondary bracts face alternately in two directions at right angles to each other. But in Scaphochlamys there is a two-keeled secondary bract immediately facing the primary bract and enclosing the whole cincinnus with its bracts and flower-buds. Within this two-keeled bract the remaining secondary bracts are normally placed. In Kaempferia we have a similar arrangement; except that only one flower is present,

and the two-keeled bract becomes two-lobed or even separated into two narrow bracts. Such two-keeled bracts, in the same position at the base of a lateral cyme, occur in Juncaceae, Cyperaceae, Pandanaceae, Gramineae and other monocotyledons; and they occur also in Marantaceae, Lowiaceae and in Heliconia (Musaceae). It seems likely therefore that the presence of such bracts in Scaphochlamys is a survival of an ancestral type, and that in Alpinia and other genera such bracts have been lost. In some cases however it is not at all easy to understand whether the two-keeled secondary bract has survived or not; this is especially true where the secondary bracts are tubular.

Tubular secondary bracts. The distinction between tubular or cup-shaped secondary bracts and those which are open to the base appears to be important; the tubular form predominates in the Alpinia tribe, the open form in the Hedychium tribe. As the bases of leaf-sheaths throughout the family are tubular, it seems reasonable to regard the tubular form as the most primitive, though comparison with such structures in allied families needs to be made before this can be regarded as more than a tentative suggestion. Taking this as a basis however, the genera of the Alpinia tribe can all be shown to be derivative from the Alpinia type, with its developed cincinni having all secondary bracts tubular or cup-shaped. On the same assumption, the genera of the Globba and Hedychium tribes have departed more from the primitive type, and this seems probably to be the case also as judged by other criteria.

In some species of Alpinia, Geostachys and Elettaria, the tubular secondary bracts are so large that each encloses the whole of that part of the cincinnus which lies beyond it, up to a late stage of development. The tubular bract encloses at its base not only the shoot which lies in its axil but also the main axis, and with it the flower at its apex until that flower is almost ready to open.

Modifications of the Inflorescence. The following are the principal types of modifications which occur, the terminal inflorescence with developed cincinni and tubular secondary bracts being regarded as primitive. Further details are given in the discussions of the individual tribes and genera.

1. *Specialization of the flowering shoot.* The flowers are borne on a leafless shoot, often short, sometimes almost entirely underground or decumbent. This occurs in many genera, sometimes in all species, sometimes in part only.

2. *Reduction or increase in size of the primary bracts.* Where the inflorescence is near the ground, or partly embedded in the ground, the protection of well-developed primary bracts is needed; on the other hand, in some genera the primary bracts have almost disappeared (Languas, Catimbium).

3. *Development of an involucre of sterile bracts.* This occurs only in the Hornstedia group of genera.

4. *Reduction in the number of flowers in the cincinni.* Where reduction occurs, it is usually to one flower. This has occurred in several genera of both sub-families. In some genera most species have one flower, while others have two or even more, but this is not usual. An interesting case is *Hornstedtia leonurus;* another is *Zingiber Clarkei.*

5. *Reduction in length of cincinni.* In Camptandra, Scaphochlamys and Curcuma the cincinni have each several flowers, but their axes are reduced greatly in length so that the whole cincinnus is packed into the base of the primary bract, the flowers alone protruding.

6. *Modification of secondary bracts.* In the Hedychieae especially the secondary bracts are not tubular; in some genera they are much reduced in size, in others very large (Geostachys).

7. *Shortening of the rachis.* This has occurred in various genera, but especially in the Hornstedtia group and in Kaempferia.

8. *Shortening of the scape.* This occurs especially in those genera which have the inflorescence partly buried in the ground.

9. *Prostrate inflorescences.* These occur in Elettaria, Elettariopsis and Geostachys; but in Geostachys some species have erect symmetrical inflorescences. Where the rachis is prostrate, the cincinni or individual flowers all curve upwards, and a secund arrangement occurs.

10. *Plagiostachys.* Here the inflorescence is terminal on a leaf-shoot, but the stem is much shorter than the leaf-sheaths, and the inflorescence emerges by breaking through the side of the sheaths. There are also other modifications; there are main branches as in Languas, of equal

rank to the terminal branch, the cincinni are all reduced to one flower and the primary bracts are lacking.

Flowers: biology. In all reported cases the flowers of Zingiberaceae last less than 24 hours. Usually they open in the early morning and by next morning have faded. In some species of Zingiber they open in the afternoon and last only a few hours.

Few observations have been made on insect pollination of plants of this family. The flowers are all tubular and contain nectar, but insect visitors, other than ants and still smaller insects, are apparently not common. In some genera (Curcuma, Camptandra, Roscoea) there are basal spurs or appendages of the anthers which are so placed that a visiting insect must touch them and in so doing move the pollen-sacs into contact with its back, thereby receiving pollen which it carries to the stigma of another flower. But such cases are the exception. In some cases seeds are freely produced (*Costus speciosus*) and in others rarely. Self-sterility is reported in Hedychium, and hybrids are easily produced in this genus. But self-sterility cannot be universal, as I have found seeds produced by an isolated inflorescence of *Zingiber zerumbet*.

In Zingiber, Curcuma and probably to some extent in Scaphochlamys, the bases of the closely imbricating bracts hold water (in Curcuma the bracts are joined for half their length and form closed pockets) ; the bracts and flower-buds are then immersed in water, or are permanently wet and mucilaginous, and the old flowers disintegrate and add to the mucilage. A similar condition exists in the cup-shaped inflorescences of Hornstedtia. In Zingiber at least the fruits often ripen and dehisce while mucilaginous.

A mucilaginous covering for developing fruits is also found in some species of Amomum and Plagiostachys, but here the result is produced by the decay of the bracts themselves, the whole outer part of the inflorescence being thus covered for a time with a slimy mass. This can naturally only occur under conditions of moist shady forest, and the inflorescences concerned are all close to the ground.

The inflorescence is partly or almost completely buried in some or all species of several genera, notably in Achasma, Elettariopsis and Elettaria. In some cases only the expanded floral members are above ground, the tube being largely buried; the tube then must be long, and in Elettaria and Elettariopsis it is certainly of variable length, adjusting itself to suit the depth at which the ovary is placed. In some cases the fruit itself develops below the surface of the ground.

Flowers are sometimes replaced by bulbils in Globba, but this form of vegetative reproduction does not normally occur in any other genus. Usually the bulbils occur in the axils of the lower primary bracts, thus strictly taking the place not of flowers but of whole cincinni. In all other genera the rhizome is the main means of vegetative propagation, in some cases branching very freely (e.g. *Kaempferia pulchra*, many species of Curcuma).

Flowers: morphology. The form of the flower is remarkably constant throughout the family; it is in fact the character which distinguishes Zingiberaceae from all other plants. Owing to this great constancy of form, it is difficult to divide the family into natural groups on the basis of floral characters; the kinds of differences which occur are slight and in many cases subject to variation within groups the members of which are evidently nearly allied. Schumann's keys to genera are for this reason very unsatisfactory.

The Zingiberaceous flower is based on the ancestral liliiflorous type of 3 sepals, 3 petals, 3 + 3 stamens and a gynaecium of 3 parts. The sepals are always joined to form a tube, and are relatively inconspicuous. The petals are also partly joined to form a tube; in most cases they are the conspicuous outer members of the flower and thus look rather like the sepals of a lily or an orchid. It is the staminal part of the flower which is greatly modified. The one functional stamen is on the same radius as the dorsal petal, and thus belongs to the inner whorl (in contrast to the orchid flower, where the functional stamen belongs to the outer whorl). The two adjacent stamens of the outer whorl are nearly always clearly present as staminodes, small or large; there is no doubt of the position and status of these staminodes. It is the other three stamens concerning which there has been doubt or difference of opinion.

The structure which represents these three stamens, in whole or in part, is called the lip or labellum. It has exactly the same relation to the fertile stamen (as regards the general shape and symmetry of the flower) as the lip to the column in orchids; but the lip of an orchid is a petal. There have been several theories as to the origin of the Zingiberaceous labellum. (*See* Valeton Bull. Jard. Bot. Buit. 2nd Ser. XXVII: 119).

1. *Robert Brown* suggested that the labellum represents the single outer stamen only, the two inner ones developing into the stylodes (nectar-gland). The stylodes are however late developments in the ontogeny of the flower and a study of

vascular tissue gives no support to the theory of their staminal origin.

2. *Lestiboudois* and *Eichler* considered that the lip represents the two stamens of the inner whorl, the intermediate one of the outer whorl being entirely aborted. Support to this theory is given by the frequent bilobed nature of the labellum.

3. *Schumann* proposed a combination of the two theories; he suggested that in some genera the two inner stamens form the lip (e.g. in the bilobed lips of Hedychium and Kaempferia) and in other cases that the single outer stamen forms the lip (e.g. in Alpinia, where the lip is not bilobed).

4. *Costerus*, after examination of the vascular strands in the various parts of the flower, considered that the labellum consisted of a combination of all three stamens, the middle one being sometimes more strongly, sometimes less strongly developed. Valeton reports Costerus as stating that in Zingiber itself the vascular strand corresponding to the single stamen of the outer whorl is quite lacking.

5. *Troll* (quoted by Loesener in Pflanzenfam. Ed. 2, 15A: 551) considers that in the large labellum of Costus all 5 stamens other than the fertile one are combined.

The theory of Costerus appears to be the most satisfactory. It explains the existence of the broad trilobed lips of some Alpinias as well as the more or less bilobed lips of some other genera. Troll's amplification to the case of Costus also explains the large labellum of that genus and complete absence of separate lateral staminodes of the outer whorl.

The structure of the functional stamen is normal. Its appendages are of various form but none is a striking structural modification. The most frequent type of appendage is an apical extension of the connective into a more or less lobed and spreading lamina, reaching its greatest development in Cyphostigma. This structure is usually called the *anther-crest*. It is fairly constant within some groups of species (e.g. Amomum, Cenolophon) but in other groups of quite closely related species it may be present or absent (e.g. Boesenbergia). Thus it is not often a satisfactory generic character, though in some genera or sub-genera it may be useful.

The basal extensions of the pollen-sacs are probably of more diagnostic value than the apical crest of the connective; but here also they are not always constant within a genus, as can be seen in Curcuma.

The remarkable feature of the stamen is the way in which it always holds the style between the swollen pollen-sacs; this is a unique feature of the family.

Ovary, fruit and seeds. The ovary is always inferior, as in all other Scitamineae. In the Liliiflorae it has its counterpart in Amaryllidaceae; but Zingiberaceae are not nearly related to any extant members of that family, which has become adapted mainly to strongly seasonal or dry climates.

The ovary of Zingiberaceae is either trilocular with axile placentation (in most genera) or unilocular with parietal placentation (the Globba group); or in some genera (Kaempferia and allies) there is a tendency to the reduction or elimination of the septa, the ovules being confined to a small basal group or to a larger or smaller columnar placenta, sometimes apparently with partially formed septa joined to it in the basal part of the ovary. This last development is not confined to a single genus, but seems to have arisen on various lines within the Kaempferia group. In at least one species of Scaphochlamys there may be only a single ovule. Similarly, within the Alpinia group there seems to be a tendency to incomplete development of the septa in some species of Languas in which there are few ovules. These modifications of the ovary need further investigation.

Still more is further investigation of fruit-structure necessary. For many species no data at all are available. Valeton first described the structure of the fruits of some long-known species of Zingiber, and he made many new observations on the fruits of other genera.

The fully dehiscent type of fruit, with the three valves separating to the apex and spreading apart, is apparently found in only a minority of cases. It occurs in Hedychium, Zingiber (the dehisced fruit here still enclosed by the large bracts), Roscoea and Globba. In Costus dehiscence occurs, with extrusion of the groups of seeds, but the splitting does not reach the apex of the ovary, which is crowned by the persistent and very tough calyx. In Catimbium (Alpinia p.p. of Schumann) the fruits break open completely on the normal three lines of dehiscence if pressed slightly, but do not open naturally. In Hornstedtia the fruits are reported by Valeton to break open irregularly in their basal parts, while still enclosed by the persistent involucral bracts. In some species of Amomum and other genera the fruits are

quite fleshy and indehiscent. In other species of Amomum they are thin-walled but perhaps not dehiscent.

The seeds are always provided with an aril. This is in the form of a basal cushion in Costus, but more or less envelopes the seed in other genera. In the Hedychium and Globba groups the aril is deeply lacerate; in the Alpinia group not or little lacerate. In the Alpinia group the seeds are closely packed in the ovary, angled where they meet, with rounded outer surfaces where they are in contact with the ovary wall. In the Hedychium-Zingiber group they are ellipsoid or ovoid and hardly angled, apparently due to less close packing; the interstices being filled in some cases by the tangled lobes of the arils.

Internally the seeds contain perisperm (nucellus) which in all cases investigated is white and starchy, and also endosperm round the embryo. The base of the seed has a plug, with which the radicle of the embryo is in contact; on germination this plug is pushed out by the growing radicle. The arrangement is closely similar to that of Musa.

Systematy of the family: historical. Linnaeus knew so little of Zingiberaceae that his small contribution to its systematy has been rather an embarrassment than a help to later botanists.

The first good botanical descriptions, made from living plants, were by Koenig, published in Retzius' *Observationes* (1783). As noted by Schumann, Koenig's descriptions are much better than many of those of later authors; but even with all his care Koenig did not always include the details necessary for certain recognition of his species.

The next considerable contribution was by Roxburgh, who also studied the plants alive, in many cases under cultivation at Calcutta. To him we owe the real foundation of our knowledge of the family. Unfortunately he did not always use Linnean generic names in the Linnean sense. Nineteenth century botanists mainly followed Roxburgh's system, and the result has been a confusion in the application of the names Amomum and Alpinia which botanists of the present century have still failed to clarify, largely because nobody has yet clearly defined the limits of the genera concerned.

Wallich continued Roxburgh's work by publishing excellent plates of several species in his *Plantae Asiaticae Rariores.*

Roscoe made considerable studies of plants in cultivation at Liverpool, and published a valuable series of coloured plates in 1828.

Blume published short diagnoses of many species native in the Netherlands Indies, but unfortunately these are quite inadequate for recognition of the plants, and the later descriptions of Miquel are little better. The first satisfactory work on the Zingiberaceae of Java was by Valeton (see below).

Griffith made a small contribution to our knowledge of Malayan Zingiberaceae, valuable chiefly for his drawings of species of Achasma and Hornstedtia (1851).

In 1861 Horaninow published the first monograph of the family; it contained little original material but is valuable as a summary of knowledge up to that time.

Baker described the Zingiberaceae of India (including those known from the Malay Peninsula) in the *Flora of British India* (1890–1892). Here are many new species, including some from Malaya, but the descriptions are too brief, and being founded in many cases on dried specimens only are sometimes misleading or inaccurate. Fortunately we have in the Singapore herbarium duplicate specimens of most of the type collections of Baker's Malayan species.

Baker subsequently described the Zingiberaceae for the Flora of Tropical Africa, some of them being illustrated in Hooker's *Icones*. Schumann had also previously (1892) published an account of African Zingiberaceae.

In 1899 Schumann described collections of Zingiberaceae (mainly dried material) from German New Guinea, and also from Celebes, Borneo and other parts of Malaysia; this study, and his former work on African Zingiberaceae, led to his undertaking a monograph of the whole family for the *Pflanzenreich* (see below).

In 1899 also Ridley published his first account of the Scitamineae of the Malay Peninsula. This was based mainly on his own collecting and that of Curtis during the previous ten years, and included 53 new species. In some cases the species were described from plants cultivated in Singapore or Penang, and of these coloured drawings usually exist; in the majority of cases the descriptions are based on dried material and field notes. It says much for Ridley's energy and zeal as a collector that the majority of Peninsular species were described by him in this early paper. His descriptions however leave much to be desired, and if we had not his specimens and drawings a great proportion of the descriptions would be valueless. The figures given for dimensions of parts of flowers are rarely even approximately accurate; and even comparative statements (such as staminodes longer than petals) are sometimes wrong. In many cases species are wrongly placed generically, and the new genera Carenophila and

Conamomum (both in my opinion superfluous) are so inaptly described that Schumann placed them in the wrong sub-division of the family. Ridley's account of the family in his *Flora* (vol. 4, 1924) is not any more satisfactory than his paper of 1899.

Simultaneously with Ridley's work, Gagnepain described many new species of Zingiberaceae, chiefly from Indochina; and he wrote an account of the family for Lecomte's *Flore Générale de l'Indochine* (1904). Gagnepain's observations are evidently based on careful examination of material, and so far as they go are admirable; but they sometimes do not include the details of inflorescence-structure which seem to me important. He made little contribution to the definition of genera in the family.

Schumann's final and most important work appeared in 1904 as a monograph of the whole family, published in Engler's *Pflanzenreich*. Nearly half the species in that volume were originally described by Schumann himself; but most of these were based on dried material, and it is only too evident that Schumann had little first-hand knowledge of living plants of the family. The main failings of Schumann's Monograph, in my opinion, are (1) his lack of attention to the structure of the inflorescence and (2) his failure to realize that single floral structures, especially the crest of the anther-connective, are rarely sufficiently distinctive and constant to characterize genera, never to serve as bases for larger divisions of the family, except for the case of the petaloid development of the staminodes. As shown by Valeton, Schumann's genera are consequently in many cases very confused.

So far as Malayan species are concerned, Schumann's work is almost valueless, as he saw specimens of few of Ridley's species. He merely copied Ridley's descriptions, the errors in which often caused him to misplace the species. His keys sometimes enable one to find species from Borneo or elsewhere which may be related to Malayan species, but often the data are so insufficient that one is left in uncertainty.

A work such as Schumann's should serve as an opportunity for a thorough revision of nomenclature. Apart from the fact that his generic concepts are unsatisfactory, and the consequent name-changes therefore sometimes wrong or unnecessary, he leaves unsolved two of the major problems of nomenclature, namely the status of the names Amomum and Alpinia. As regards Amomum, he removed the remaining Linnean species from that genus and used it as the type for a new genus Aframomum; he only retained the use of the name Amomum, for those Asiatic plants so

called by Roxburgh and later writers, by an interpretation of *Amomum cardamomum* L. which will not bear criticism (*see* Burkill in Kew Bull., 1930, p. 32). It is perhaps fortunate that he did so; otherwise he might have proposed a new generic name for the Asiatic species. I very much question whether his genus Aframomum is really distinguishable from the Asiatic Amomum; certainly the characters he gives in his generic key do not distinguish the two. If the African and Asiatic species may be retained together in one genus, we may revert to *Amomum granum paradisi* Linn. as the type species and no question of a *nomen conservandum* need arise.

The question of Alpinia is discussed at length under that genus. There is no doubt that Alpinia in Schumann's monograph does not contain the only Linnean species of 1753; there is equally no doubt that it does contain a great mixture of species which should, when further studied, be separated into several genera. It is therefore unreasonable to apply the next generic name (Languas Koenig) to all Schumann's species indiscriminately. This attitude is adopted by Loesner (*Pflanzenfam.* Ed. 2, Bd. 15A: 611, 1930), who retains the name Alpinia in Schumann's sense pending a further revision of the species. As will appear later, the name is here used in a different, restricted, sense.

About the time when Schumann published his monograph, Valeton began to take an interest in the Zingiberaceae of Java. His first paper (1904) dealt mainly with Hornstedtia, Achasma and Phaeomeria, and about the same time he published a series of valuable illustrations of these and other species in *Icones Bogorienses*. His later papers dealt mainly with the same genera, and with Curcuma, Gastrochilus, Kaempferia and Zingiber. His studies were extremely thorough, and he described the structure of the inflorescence of many species for the first time, even in the case of some which had been well known for over a century. His work in fact represents a great advance towards an understanding of the family, and on it the present account is largely based. Unfortunately Valeton was not able to complete his work by making any general survey of the family.

The only publication of importance subsequent to Valeton's work is Loesner's account of Zingiberaceae in the second edition of Engler's *Pflanzenfamilien* (Bd. 15A, 1930). Loesener refers to Valeton's work, but he is unable to adopt all of Valeton's generic and sub-generic concepts because many species are not known in sufficient detail; and though he attempts to straighten the confusion of Schumann's genera Gastrochilus and Kaempferia, his rearrangement contains errors due to inaccurate descriptions

by previous authors. He adopts the genus Geanthus, as defined by Valeton, without consideration of the fact that the name is invalid. There is no question that a fresh study of all species is necessary, based on good material (including inflorescences and flowers either living or in alcohol), before any satisfactory new account of the family as a whole can be written.

Systematy of the family: a proposed revision. The present study being confined to species of the Malay Peninsula, I cannot attempt a complete revision of the genera of the family; but I think that my observations justify a partial revision, and also provide suggestions for further investigation of non-Malayan species.

Schumann's division of the family into the two subfamilies Zingiberoideae and Costoideae is certainly valid, and I would retain it as the main division. The sub-family Costoideae includes (in Malaya) only the genus Costus, and need not concern us further at present.

Schumann's sub-division of the sub-family Zingiberoideae on the other hand seems to me unsatisfactory. I would base the main division, as he does, on the petaloid development of staminodes but Zingiber itself belongs with Hedychium and the rest which have petaloid staminodes, not with Amomum and Alpinia. It is evident from Schumann's note after the generic diagnosis of Zingiber that he recognized this, and he does not at all explain why he placed Zingiber with Amomum, nor how he would include Zingiber under "staminodia lateralia parva minutissima vel 0" if he regards (rightly) the lateral lobes of the lip of Zingiber as staminodes. The separation of Globba, together with Mantisia, Hemiorchis and Gagnepainia, appears satisfactory. Thus we have the three tribes Hedychieae (including Zingiber), Globbeae and Alpinieae (Schumann's Zingibereae, without Zingiber). The following then is the scheme proposed:

Leaves distichous, with sheath open on the side opposite the lamina; lateral staminodes usually present though in many cases small; stylodes (nectar glands) various, always more or less columnar, rarely absent
Zingiberoideae (Subfam. 1).

Lateral staminodes petaloid, free from the labellum; or in Zingiber more or less deeply adnate to the labellum (Zingiber may also be recognized by the long narrow curved anther-crest, with inflexed edges, embracing the style).

Ovary unilocular with parietal placentae
Globbeae.

Ovary trilocular with axile placentae, or unilocular with basal or free columnar placenta
Hedychieae.

Lateral staminodes never petaloid, sometimes lacking; usually present as small teeth or short linear appendages at the base of the lip, in Geocharis joined to the filament *Alpinieae*.

Leaves spirally arranged, with sheaths tubular, closed on the side opposite the lamina; staminodes absent (as individual structures); stylodes absent, nectar glands embedded below base of flower-tube *Costoideae* (Subfam. 2).

The name Hedychieae is used instead of Zingibereae, because Schumann's Zingibereae was very different. For convenience of use as a key covering Malayan genera only, we may add to the above scheme a note referring to the distinctive features of Globba itself as contrasted with the Hedychieae, the other genera of Globbeae being lacking in Malaya.

The sub-division of the tribes I would base almost entirely on characters of the inflorescence and bracts, as indicated below, as this appears to give a much more natural arrangement than Schumann's, which is based mainly on unstable flower-characters.

Relationship to other Families. As noted under the discussion of floral morphology, there is no doubt that the Zingiberaceae have a common origin with those families known as Liliiflorae. There is also little doubt that Zingiberaceae are monophyletic; the remarkable uniformity of flower-structure in the family, and the absence of anything resembling it in other families, is strong evidence that all Zingiberaceae arose from a common ancestor.

The other families placed with Zingiberaceae in the Order Scitamineae are Musaceae, Lowiaceae, Marantaceae, Cannaceae. Of these, Musaceae and Lowiaceae each have five stamens (exceptionally six in Musaceae) and are to that extent more primitive than Zingiberaceae, but they are also very specialized and bear little resemblance to Zingiberaceae. The nearest resemblance is with Heliconia, as regards vegetative appearance and morphology of the inflorescence; but it is improbable that Zingiberaceae arose from Heliconia. It seems more likely that these other families had separate origins in the Liliiflorous stock, which is certainly an ancient one.

As remarked by Engler, the probable origin of Zingiberaceae is from tall rhizomatous plants of the aspect of Dracaena, with a branched terminal inflorescence having the ultimate branch-systems cymose. Dracaena has a superior ovary; but the transition from superior to inferior is one that has occurred on many different lines of evolution, and the Zingiberaceae-ancestor must have experienced that transition, though Dracaena did not.

The Zingiberaceae-ancestor must have been a plant of tropical evergreen forest; and judging by the existing distribution of the family the place of origin was within the Indo-Malayan region.

Zingiberaceae as members of the flora of Malaya. Zingiberaceae are a characteristic feature of the ground flora of the primitive forest of Malaya. They are infrequent in secondary forest, and very few native species will stand the full exposure of the sun. In the forest, one meets them everywhere, usually as scattered plants, rarely as thickets. Some are found only in wet places, others on hillsides. They are most abundant in lowland and mid-mountain forest; few are seen on high mountain ridges. One species (*Hedychium longicornutum*) is epiphytic.

The total number of species at present known is here reckoned to be 150. Putting the total number of species of flowering plants at 7,000, this is about two per cent. This may be compared with the Orchidaceae, our largest family, which includes more than 780 known species, or say eleven per cent of the flora.

Some species of Zingiberaceae are found throughout the country; such as *Globba pendula, Costus speciosus, Camptandra parvula, Alpinia javanica, Achasma macrocheilos, Amomum xanthophlebium, Hornstedtia scyphifera.* Other species appear to be extremely local, notably several species of Scaphochlamys (which are almost confined to lowland forest) and of Geostachys (which are nearly all mountain plants).

As regards the occurrence of our species outside Malaya, little can be said with certainty, owing to the imperfect descriptions of so many species, and to the fact that the Zingiberaceae of Borneo and Sumatra, the countries most likely to have species in common with Malaya, have been comparatively little investigated. There is little doubt that many of our common species occur also in Sumatra and Borneo, as is the general rule for common lowland Malayan species.

As regards northward distribution, we can say with a high degree of probability that few of our species spread far; included in these few are some (such as *Costus speciosus* and *Catimbium muticum*) which will tolerate moderate or full exposure, and others (such as *Curcuma parviflora*) which are at their southern limit in northern Malaya.

KEY TO THE MALAYAN DIVISIONS OF ZINGIBERACEAE.

Leaves distichous, with sheaths open on the side opposite the lamina.

Lateral staminodes petaloid, free from the labellum; or in Zingiber more or less deeply adnate to the

labellum (Zingiber also has a long narrow anther-crest with inflexed edges, embracing the style).

Lip and filament joined together for some distance above the insertion of petals and staminodes; filament very long as compared with lip *Globba* (p.).

Lip and filament not so joined; filament nearly always much shorter than lip *Hedychieae* (p.).

Lateral staminodes never petaloid, sometimes lacking, usually present as small teeth or short linear appendages at the base of the lip *Alpinieae* (p.).

Leaves spirally arranged, with tubular sheaths *Costus* (p.).

GLOBBA Linnaeus

Rhizome slender, creeping, bearing leaf-shoots close together or well-spaced; roots often rather fleshy. *Leaf-shoots* slender, usually 30–90 cm. tall to the top of the highest leaf-sheath, bearing about 3–8 leaves in the upper ½—2/3. *Leaf-blades* usually sessile or nearly so, slightly asymmetric, elliptic, usually more or less caudate-acuminate, thin, glabrous or variously pubescent; ligule broad, not lobed, usually 1–5 mm. high, ciliate or glabrous. *Inflorescence* terminal, erect or decurved; *peduncle* slender, short or long, usually bearing a few sterile bracts; *rachis* slender, short or long, bearing few to many slender branches in the axils of small, often early deciduous, primary bracts; *branches* bearing few to many flowers arranged in a cincinnus; *secondary bracts* smaller than the primary bracts, deciduous or persistent, more or less ovate, not tubular at the base; *pedicels* of flowers 0–7 mm. long. Flowers small, white, yellow, orange or purplish, often with a brown or purple spot on the lip. *Calyx* funnel-shaped, subequally 3-lobed, the lobes often having hollow spur-like subapical tips. *Corolla-tube* slender, much longer than the calyx; *lobes* usually 5–6 mm. long, spreading or deflexed, subequal, ovate, concave, the dorsal one with a short subapical hollow pointed spur. *Staminodes* attached to the flower-tube at the same level as the corolla-segments, as long as to twice as long as the corolla-segments, elliptic or oblong, not concave. *Labellum* joined to the stamen in a slender tube about 1 cm. above the attachment of the staminodes and corolla-lobes, its base narrow with two small auricles, its deflexed blade remaining close to the flower-tube except towards the apex, widening gradually from base to apex, apex more or less deeply bilobed, the lobes rounded, contiguous or somewhat divergent, their tips near the level of attachment of the staminodes. *Filament* long, slender, curved, with inflexed edges embracing the style; anther small, the pollen-sacs parallel,

bearing two or four narrow acute spreading lateral appendages; connective not or hardly produced at the apex. *Ovary* unilocular with three parietal placentae and several ovules on each; fruit a small dehiscent capsule; *seeds* ovoid, usually short hairs all over, with a lacerate basal aril.

The genus Globba is almost confined to the region from the eastern Himalayas and southern China southwards to Malaysia. The greatest number of species have been described from Burma and N.E. India, but it is very likely that more occur in western Malaysia than have yet been reported or collected. It appears however that there are few species in Java. Discrimination of species, and effective description, is not easy, and the range of distribution of individual species is consequently in many cases doubtful: there is certainly some duplication among published species.

Ridley enumerates twenty one species in his Flora; these are here reduced to eight, with the addition of one new species and also *G. marantina* which he did not regard as native. In some cases varietal rank is given to Ridley's species; others are shown to exist only on a basis of inaccurate observation.

The form of the inflorescence in Globba, with its spreading branches often bearing many distinctly spaced and pedicelled flowers, is only matched by Alpinia and Languas. It is nearest to Languas, as in Alpinia proper the cup-shaped persistent flowering bracts give a different aspect and obscure the nature of the branching. Each branch of Globba is a true cincinnus, each flower in turn being terminal, and the axis continued by a lateral bud in the axil of a secondary bract. This bud may arise very close below the flower, in which case the latter appears to be sessile (and is so called, for convenience, in the following descriptions of species) ; or it may arise a few millimetres below the flower in which case the flower appears to be pedicelled. This distinction of sessile or pedicelled flowers is often useful for the discrimination of species.

The number of flowers borne on each branch of an inflorescence, as well as their spacing and length of pedicels, is on the whole fairly constant for each species; but this cannot well be judged if only young inflorescences are available. It is often difficult to compare specimens with young and old inflorescences, as they present different characters, the old ones having often lost all the bracts which are the conspicuous feature of the young ones.

The basis of subdivision of the genus has always been the number and character of the anther-appendages, and this appears to give a very natural arrangement. There

appear to be no species in Malaya without any anther-appendages, the report of such being due to poor specimens or inaccurate observation.

Apart from the anther, the shape of the flower in the genus is remarkably constant, and also its size. The most variable feature is the length of the staminodes; next come the length and divergence of the lobes of the lip and the length of the corolla-tube.

In the section with two anther-appendages, flower-colour is variable within a single species; *G. violacea* Ridl. is for example no more than a colour-variety of *G. leucantha*, differing in no morphological feature. In the section with four anther-appendages flower colour appears to be more constant.

Apart from their small size, the most remarkable features of the flowers of Globba are the union of the lip and filament for some distance above the junction of the corolla-lobes, and the great disparity in length between the filament and the other members of the flower. The filament is long in Hedychium, but not greatly longer than the corolla-lobes.

Vegetatively there is a good deal of variation within some of the species, and it is difficult sometimes to know where to draw limits. Pubescence is especially variable, and there is hardly a species which is quite glabrous. Size of leaves (and of plants) varies much, especially in *G. pendula*, and so continuously that one can hardly discriminate varieties based on this character. There are however certainly some species with smaller or narrower leaves than others (e.g. *G. Curtisii, G. albiflora*).

All species are plants of shady forest, except *G. marantina*, and most of them are widely distributed. None (except perhaps *G. Curtisii*) is exclusively montane. Different species often grow side by side, and it is possible that hybridization may occur, though there is no definite evidence of this. Fruits do not appear to be very abundantly produced, being especially infrequent on some species (e.g. *G. cernua*). Bulbils, on the other hand, are frequent, and perhaps more plants are so propagated than from seeds. This makes for efficiency in dispersal, and could also ensure the propagation in unchanged condition of a hybrid, if such should occur. It might for example explain the local occurrence and constancy of *G. Curtisii;* if this were a hybrid, it could reproduce itself unchanged by bulbils, whereas seeds, if produced, would certainly involve various re-groupings of parental characters. This would be an interesting subject for experimental investigation. Artificial hybrids have been freely produced in Hedychium; they might be equally possible in Globba.

KEY TO THE SPECIES OF GLOBBA IN MALAYA

Bracts broad and imbricating, the lowest 1·5–2 cm. long, all or nearly all with axillary bulbils c. 1 cm. long; flowers rarely produced . . . . . 1. *G. marantina.*

Bracts not or hardly imbricating, usually much smaller, axillary bulbils when present much smaller; flowers nearly always produced on several branches

Anther with two appendages; flowers white, yellow, orange or purple

Appendages attached at the basal angles of the anther, their bases sometimes decurrent along the sides of the anther towards its apex

Leaves bearing short stiff hairs or papillae all over the upper surface between the veins; branches of inflorescence white, bearing ultimately a succession of up to 12 flowers; flowers mainly white or violet, never deep yellow

Flowers white with purple spot on lip 2. *G. leucantha*, typical.

Calyx white, rest of flower violet *var. violacea.*

Staminodes pale yellow, rest of flower ± tinged with violet *var. bicolor*

Flowers yellowish *var. flavidula.*

Leaves glabrous above or bearing stiff hairs on main veins only; branches of inflorescence often purplish, with few flowers, flowers orange or white

Staminodes longer than corolla-lobes; leaves glabrous above, proportion of length to width 5–6:1 3. *G. fasciata.*

Staminodes hardly longer than corolla-lobes; leaves with stiff hairs on main veins above, proportion of length to width 3–4:1

Flowers orange with a brown spot on the lip 4. *G. pendula*, typical.

Flowers white with a purple spot on the lip *var. elegans.*

Appendages spreading from about the middle of each side of the anther, their bases occupying the whole length of each side 5. *G. albiflora.*

Anther with four appendages; flowers always orange or yellow

Inflorescence decurved, so that the rachis points vertically downwards

Peduncle in a broad curve, usually as long as or longer than the rachis, inflorescence lax; leaves 4–7, petioles short 6. *G. cernua.*

Peduncle very short, abruptly curved, inflorescence dense; leaves 1–4, petioles to 3 cm. long 7. *G. unifolia.*

Flowers on pedicels 3–4 mm. long *G. unifolia*, typical.

Flowers sessile or nearly so *var. sessiliflora.*

Inflorescence erect or somewhat curved, rachis not pointing vertically downwards

Leaves to about 13 by 3·5 cm., glabrous or nearly so; staminodes c. 1·1 cm. long, much longer than corolla-lobes 8. *G. Curtisii.*

Leaves of well-grown plants much wider, usually hairy beneath; staminodes shorter, about same length as dorsal corolla-lobe

Flowers on pedicels 4–7 mm. long; leaves usually long-hairy beneath, and sheaths similarly hairy 9. *G. aurantiaca.*

Flowers sessile; leaves at most short-hairy beneath 10. *G. variabilis.*

1. **Globba marantina** Linn., Mantissa 2: 170. 1771. Roxb., Fl. Ind. 1: 77. 1820. Bak., F.B. I. 6: 206. 1890. K. Schum. Pflanzenr. Zingib. 156. 1904. Ridl. Flora 4: 241.

Stems to c. 50 cm. tall to top of uppermost leaf-sheath, bearing c. 8 or more leaves. *Leaves* to about 15 cm. long and 4–5 cm. wide, apex acuminate, base cuneate, lower surface minutely hairy, upper surface glabrous; *petiole* of upper leaves usually distinct, c. 5 mm. long or longer; *ligule* hardly 2 mm. long, fringed with hairs; sheaths short-hairy to almost glabrous. *Peduncle* hardly exserted beyond the leaf-sheaths. *Inflorescence* compact, 2–3 cm. long, of c. 8–10 imbricating bracts (or the lowest not quite imbricating), usually with a bulbil in the axil of each bract or sometimes with a flower in the axil of one or more of the upper bracts. *Lowest bracts* c. 1·5–2 cm. long and 1 cm. or more wide, upper gradually smaller, green, ovate, the apex very shortly pointed, edges fringed with a few hairs and surface sometimes short-hairy. *Bulbils* c. 1 cm. long, narrowly ovoid to conical, surface irregularly warty. *Flowers* when present yellow; staminodes longer than corolla-lobes; lip with apex much below base of corolla-lobes; anther with 4 spurs.

This species appears to be based on Rumphius' *Lampujum silvestre minus* (Herb. Amb. 5: 150, t. 64, f. 2). It occurs widely in the Philippines and New Guinea, and perhaps eastern Malaysia is its main centre of distribution. It evidently rarely flowers; Rumphius remarked that the fruits (i.e. bulbils) developed without flowers preceding them. In Malaya this species behaves as do many others which are adapted to seasonal climates; it is found in the north (in Peninsular Siam and Penang) and also down the east coast where it has been found by Corner "in dry forest on sand banks in scattered troops, apparently wild", at Jason Bay, Johore (S.F.N. 28538). Ridley says that it occurs in Malaya as a weed in gardens introduced from Java; but it has never been reported as a village plant in Malaya nor as used by Peninsular Malays. It is readily spread by its bulbils and readily establishes itself in a suitable environment, and it is probable that man has had a considerable part in its present distribution.

The only flowering specimen in the Singapore Herbarium was collected in the Botanic Gardens, Singapore, in 1896. Evidently the flowers develop first, from an upper bract, before the bulbils are formed; the bracts at this time are closely imbricating and the whole inflorescence is about 8 mm. in diameter, whereas it widens to more than 2 cm. when the bulbils are fully grown.

2. **Globba leucantha** Miquel, Fl. Ind. Bat. Suppl. 612. 1860. Ridl. J.S.B.R.A.S. 32: 95. 1899. Flora 4: 238. *G. pallidiflora* Bak., F.B. I. 6: 204. 1890. *G. floribunda* Bak., F.B. I. 6: 203. 1890. **Fig. 1.**

Roots sometimes bearing tubers. *Stems* close together, to about 80 cm. tall to top of highest leaf-sheath; basal sheaths short-hairy. *Leaves* to 26 by 8 cm., elliptic, apex caudate (cauda 2–3 cm. long) base cuneate, upper surface bearing short stiff hairs all over, and longer ones on the main veins, lower surface usually purplish when young, softly short-hairy all over, with longer hairs on midrib towards the base; *petiole* lacking; ligule to about 4 mm. long, densely covered with stiff hairs about 1 mm. long; sheath hairy like the ligule, or sometimes the hairs shorter, often mottled with purplish blotches. *Inflorescence* c. 15–30 cm. long above the uppermost leaf-sheath, erect, the rachis minutely hairy to sub-glabrous, the branch rachises green and hairy towards the base only, towards the apex white and glabrous; inflorescence sometimes on a short stem bearing no normal leaves (sheaths only). *Primary bracts* early deciduous, about 1 cm. long (?). *Branches* numerous, c. 3–10 mm. apart, the lower ones up to 2·5 cm. long to the first flower, the upper ones shorter, each bearing a succession of up to about 12 flowers at intervals of 2–4 mm. *Floral bracts* about 4 mm. long, broad, acute, glabrous, usually deciduous at flowering. *Calyx* with ovary c. 5 mm. long; 2 teeth acute, the third less so, white, shining. *Corolla-tube* minutely hairy; c. 1 cm. long, white; lobes c. 5

mm. long, white, all deflexed or the dorsal one erect, concave, the dorsal one with short hollow sub-apical spur. *Staminodes* a little longer and narrower than the corolla-segments, not concave, white, reflexed. *Labellum* about 8–9 mm. long, joined to the stamen for about 1·1 cm. above junction of corolla-lobes and staminodes, oblong, apex shortly bilobed, white with a small purple spot. *Filament* extending about 1–1·5 cm. beyond junction with lip; anther 2·5 mm. long, with narrow curved acute spurs at the base. *Fruit* green, smooth, 3-lobed, c. 8–10 mm. long, crowned by the persistent calyx.

This species is common in forests in the southern part of Malaya, and in Singapore island, where it is abundant on Bukit Timah; it extends northwards to Perak and has not been found in Penang. It is allied to *G. pendula* but has a shorter inflorescence with longer branches bearing more flowers on each, the branches are white, the corolla-lobes and staminodes are usually deflexed and the lip does not extend downwards to the base of the corolla-lobes; the leaves are larger than in *G. pendula* and have short stiff hairs all over the upper surface, so that they are slightly rough to the touch.

Ridley is responsible for identifying the Peninsular specimens here described with Miquel's *G. leucantha* from Sumatra; Miquel's description would cover them, but it is very incomplete. Baker proposed two new species, *G. pallidiflora* and *G. floribunda*, based on Malayan specimens, which Ridley identifies as *G. leucantha*. If it should be discovered that Miquel's species is different, one of Baker's names should be revived, after checking the type specimen at Kew.

var. violacea (Ridl.) Holtt., **stat. nov.** *G. violacea* Ridl. J.S.B.R.A.S. 32: 97. 1899. Flora 4: 239.

Calyx white; corolla and staminodes violet; lip violet with a darker spot towards the yellowish apex; anther violet.

Ridley called this *G. violacea*, stating that the corolla-tube is much shorter and the lip much narrower than in *G. leucantha*. The shorter corolla-tube is not evident in specimens available. Apart from flower-colour, the differences from typical *G. leucantha* are so slight that I rank this as a variety. There are several collections, in lowland and mid-mountain forest, from Johore to Perak. They are vouched for by Ridley; only the type (from G. Pulai, Johore) has a note of the flower colour. As dried specimens they are indistinguishable from *G. leucantha*.

var. bicolor, Holtt., **var. nov.** *G. regalis* Ridl., Journ. F.M.S. Mus. 4: 75. 1909. Flora 4: 237.

Leaves minutely scabrous on the upper surface (hardly hairy); calyx and corolla-lobes more or less flushed with violet, staminodes and apical lobes of lip pale yellow, base of lip

white or flushed with lilac, stamen yellow, spurs sometimes tinged with violet.

Pahang. Telom, Ridley 13905 (type of *G. regalis*). Lubok Tamang, 3,500 feet, Henderson 10930 (F.M.S. Mus.). Raub, 400 feet, S.F.N. 16872 (Burkill). *Kelantan.* Kuala Lebir, Gimlette s.n. 1905, with coloured drawing (type of var.). Bukit Batu Papan, Sungei Lebir, 1,000 feet, S.F.N. 29524 (Henderson). *Trengganu.* Sungei Nipa, Kemaman, Corner s.n. 20 November, 1935.

In the type, the corolla-lobes are represented as deep violet with paler mottlings and the calyx and base of lip pale violet (lilac); Corner's notes are "flowers white, calyx and corolla-lobes very slightly violaceous, staminodes and lobes of lip pale ochraceous." The habit is that of *G. leucantha* (inflorescences sometimes on short leafless stems); the leaves of all three collections however are less hairy than in typical *G. leucantha*, with all upper-surface hairs except those on the veins reduced to minute protuberances.

var. flavidula (Ridl.) Holtt. **stat. nov.** *G. flavidula* Ridl., Flora 5: 338. 1925. "Flowers yellowish."

Ridley states that this differs from *G. leucantha* in having puberulous panicles, lip more deeply cut and calyx-lobes equal. The hairiness of the rachis of the inflorescence in *G. leucantha* is very variable; this therefore cannot stand as a good distinction. The calyx-lobes are not equal on our specimen of the type collection, and it is very difficult to judge whether the lip is more deeply lobed than usual. I consider the type collection of *G. flavidula* to represent at most a colour variety of *G. leucantha*.

3. **Globba fasciata** Ridl. J.S.B.R.A.S. 57: 101. 1910. Flora 4: 236.

Differs from *G. pendula* Roxb. in the following characters. *Leaves* narrower, in type specimen to 19 by 2·8 cm., in another from same locality to 29 by 5·5 cm.; less hairy, bearing a longitudinal median pale band; ligule ciliate on edges only. *Inflorescence* to about 20 cm. long, peduncle very short, branches crowded (c. 4–10 mm. apart), *basal branches* c. 2 cm. long to first flower; flowers to about 5 on each branch, nearly sessile, 3–4 mm. apart, the second one often producing a fruit. *Calyx* with broader teeth. *Staminodes* c. 8 by 2 mm. *Anther-spurs* basal but with a base extending upwards along the sides of the anther, decurved, longer than anther.

This species was described by Ridley from Ulu Temango (14415A). There are three specimens in the Singapore Herbarium, the other two labelled Temango, one bearing no. 14415 and the other lacking a number. The last named was labelled "Globba near pendula" by Ridley, but it differs only in leaf-size from the others. Undoubtedly this is very near *G. pendula*, but differs from typical *G. pendula* in its narrower leaves, shorter denser inflorescence, long stami-

nodes and perhaps in the spurs of the anther having a broader base. The last distinction is not very clear; in *G. pendula* the base of the spur always runs to some extent along the side of the anther.

Ridley described the staminodes as shorter and broader than the corolla-lobes. It is clear from the specimen that he confused the staminodes with the lateral corolla-lobes which are the short broad organs, the thin narrow staminodes much exceeding them.

Globba valida Ridl. was described from a plant collected at Telom (i.e. Cameron Highlands); the specimen cannot be found in the Singapore Herbarium. It is described as having orange flowers with staminodes much longer than the lip, anther with short basal spurs, inflorescence 45 cm. long with stout branches and leaves with purple spotted sheaths. It is evidently near *G. fasciata* and might later be judged as conspecific, in which case the name *G. valida*, being older, has priority.

A specimen from K. Nerang, Kedah (Corner s.n., 10.7.1936) agrees closely with the type of *G. fasciata* in inflorescence and flowers and in glabrous leaves; the leaves are smaller (to 15 by 2.8 cm.) and there is no information as to their having a pale median band. It is possible also that Ridley's *G. montana* from Kedah Peak may belong here, but the original collections lack staminodes, have rather longer and laxer inflorescences, and some hairs on the upper surface of the leaves. It has altogether more the aspect of *G. pendula*.

4. **Globba pendula** Roxb. Asiat. Res. 11: 359. 1810. Bak. F.B.I. 6: 205. Ridl. J.S.B.R.A.S. 32: 92. Flora 4: 236. *G. Wallichii* Bak., F.B.I. 6: 202. 1890. Ridl. J.S.B.R.A.S. 32: 89. 1899. Flora 4: 235. *G. uliginosa* quoad Bak., F.B.I. 6: 203. 1890. Ridl. J.S.B.R.A.S. 32: 90. 1899. Flora 4: 235. *G. panicoides* quoad Ridl. J.S.B.R.A.S. 32: 91. 1899. Flora 4: 235. *G. Kingii* Bak., F.B.I. 6: 204. 1890. *G. montana* Ridl. J.S.B.R.A.S. 32: 42. 1899. Flora 4: 236.

Roots rather fleshy but not thickened into distinct tubers. *Stem* 25–50 cm. to top of highest leaf-sheath; basal sheaths ± red-spotted, hardly hairy except at edges. *Largest leaf-blade* 6 by 1·5 to 21 by 6 cm., narrowly ovate to elliptic; apex acuminate-caudate, base broadly cuneate to rounded, lower surface sometimes at least purplish, usually appressed-hairy all over, the midrib with stronger more spreading hairs especially towards the base; main veins on upper surface distinctly larger than intermediate veins, some of them with stiff curved hairs, the surface between main veins not hairy; midrib on upper surface also ± hairy; no petiole; ligule c. 2 mm. long, rounded, strongly setose on the edge and sometimes on the surface also; *sheath* hairy at least near base of leaf and ligule, usually

blotched with red. *Inflorescence* about 20–60 cm. long above highest leaf-sheath; peduncle usually bearing no sheaths or sterile bracts between the uppermost foliage leaf and the basal branch of the inflorescence; peduncle and rachis glabrous or nearly so, green or purple. *Primary bracts* early deciduous, basal ones to 1·5 cm. long, upper ones much shorter, all more or less hairy. *Branches* of inflorescence commonly 1–2 cm. apart, glabrous, green or purplish, varying in length from 1 to 3 cm. (excluding the flowers), each bearing 1–3 flowers near the apex; bulbils rare, but found to the exclusion of flowers on some inflorescences. *Floral bracts* about 2 mm. long, glabrous. *Calyx* about 4–5 mm. long; 2 teeth acute and one less so, 1 mm. long. *Corolla-tube* extending about 6–7 mm. beyond calyx; lobes spreading or obliquely ascending (always?) all orange; dorsal lobe strongly concave, about 6 by 3·5 mm. with a short hollow pointed spur just below the tip; laterals about 5 mm. long, concave but not spurred at the tip. *Staminodes* orange, spreading, about as long as dorsal corolla-lobe, narrower (c. 2·5 mm. wide), elliptic, bluntly pointed, nearly flat. *Lip* about 1 cm. long, slightly bilobed, orange with a brown spot, its tip about same level as base of corolla-lobes. *Filament* about 1·5 cm. long beyond the point of attachment to the lip; *anther* about 3 mm. long, with narrow decurved acuminate basal spurs as long as the pollen-sacs. *Fruits* almost smooth, hardly hairy, about 4 mm. long and wide.

As here interpreted, this species is the commonest Globba in Malaya, occurring in all parts of the country. Specimens have been named *G. Wallichii* Bak., *G. uliginosa* Miq. and *G. panicoides* Miq., but I cannot see any clear distinctions between specimens so distinguished. It is certain that the specimens in the Singapore Herbarium named *G. Wallichii* and *G. uliginosa* (species stated to lack anther-spurs) have spurred anthers exactly as in *G. pendula*. Baker described *G. Kingii*, which King informed Ridley was identical with *G. panicoides* Miq. Miquel's description of this species is very imperfect. Ridley does not however show what differences there are between *G. Kingii* and *G. pendula* Roxb. (type from Penang) and I can distinguish none from the specimens named by Ridley. *G. pendula*, as the oldest name, is therefore used.

It is quite probable (as noted by Baker in F.B.I.) that *G. maculata* Bl. from Java is the same species. Valeton states that this may have orange, pale-orange or white flowers. Ridley has described *G. elegans* from Perak, which has white flowers, but otherwise does not appear to differ from *G. pendula*; I regard it as a variety and include it below as such.

As regards flower-shape and size, *G. pendula* is very closely similar to *G. leucantha*, and I am not sure that the character of the lip being entirely clear of the corolla-lobes and staminodes always distinguishes *G. leucantha*. The best distinctions between the two species are vegetative, namely the larger leaves of *G. leucantha* with very short

stiff hairs all over the upper surface between the veins (in *G. pendula* stiff hairs only on main veins of upper surface), the longer inflorescence branches of *G. leucantha* which are distally white and shining. The inflorescence of *G. pendula* is also usually longer and more lax than in *G. leucantha*. Bulbils are sometimes produced on many lower branches of an inflorescence in *G. pendula* but I have never seen this in *G. leucantha*; but *G. leucantha* does sometimes produce bulbils on old inflorescences.

In Negri Sembilan and Malacca a very small-leaved form of *G. pendula*, with largest leaves sometimes only 6 cm. long, seems to be common. The mountain plants in Perak have much larger leaves, and being larger plants have also longer inflorescences, up to 60 cm. long. In Pahang plants have been found with rather numerous flowers (up to 8) on each branch of the inflorescence, otherwise like *G. pendula*; I have so regarded them.

It is clear however that a field study of the group is needed to observe variations of all kinds. It may be that hybridization occurs, especially in the middle areas of Malaya; *G. leucantha* is mainly a southern species, *G. pendula* mainly northern, but they overlap considerably.

var. elegans (Ridl.) Holtt., **stat. nov.** *G. elegans* Ridl., J.S.B.R.A.S. 32: 96. 1899. Flora 4: 237.

Flowers white with a violet spot on lip; leaves to about 14 by 3·7 cm., pubescence as in *G. pendula*.

Perak. Bruas Woods, Ridley 8392. Gunong Tungul, Ridley 9450.

Ridley states that the lip is entire, but it is shortly bilobed.

G. montana Ridl. from Kedah Peak has anther-spurs with an unusually broad base, but they are distinctly basal and I can see no clear distinction from those of typical *G. pendula*; they are quite unlike the spreading broad medial spurs of *G. albiflora*. In the type of *G. montana* the staminodes are lacking.

5. **Globba albiflora** Ridl., J.S.B.R.A.S. 32: 96. 1899. Flora 4: 237.

Stems to about 80 cm. tall to top of uppermost leaf-sheath. *Leaf-blades* shining green above, sometimes with a median longitudinal band of silver-grey when young, to about 24 cm. long and 3–3·5 cm. wide, usually widest below the middle, apex acuminate-caudate, base cuneate, lower surface minutely hairy throughout; no petiole; ligule c. 2 mm. long, glabrous; sheaths glabrous or very shortly hairy near base of midrib. *Inflorescence* 20–30 cm. long above uppermost leaf-sheaths; peduncle short, sometimes bearing one bract with a small bud in its axil; branches of inflorescence many, c. 3–10 mm. apart, the basal ones 2·5–3 cm. to the first flower, each bearing a

succession of up to 8 flowers; flowers usually 3–5 mm. apart (sometimes more widely spaced on lower branches). *Pedicels* distinct, dilated at the apex; to 1 mm. long. *Calyx* rather broadly funnel-shaped; teeth broad, two of them with short acute tip, with the ovary c. 6–7 mm. long. *Corolla-tube* short-hairy, to c. 1·2 cm. longer than calyx; lobes c. 5 mm. long, strongly concave, shaped as in *G. pendula* and *G. leucantha*, white. *Staminodes* c. 8 mm. long, much narrower than the corolla-lobes, white. *Lip* 6 mm. long, distal half yellow with a brown spot, apex shortly bilobed. *Filament* about 1·8 cm. long beyond attachment of lip; *anther* hardly 2 mm. long, with a broad-based spreading, hardly curved spur 3 mm. long on either side of it. *Fruit* smooth (somewhat ridged), to 1·4 cm. long not including the persistent calyx.

The typical form of this species has been found only on Penang Hill. It is characterized by narrow leaves glabrous above, rather long inflorescence-branches each bearing a succession of several flowers on distinct pedicels, a rather long corolla-tube, long narrow staminodes and a short anther with broad lateral spurs. The length of the lip is judged from a drawing and from a dried specimen; it appears to be very short.

G. paniculata Valet. from Sumatra (Ann. Btzg. 31: 18, pl. 5. 1921) is closely allied, agreeing in the narrow leaves, many pedicelled flowers, long staminodes and shape of anther-spurs, but differing in having longer, broader staminodes (1.5 by 0.3 cm.). Valeton admits both white and orange-flowered plants under this species. From Kelantan is an orange-flowered specimen which agrees closely in other respects with *G. albiflora;* I rank it below as a variety.

SPECIMENS. *Penang.* Cooly Lines Govt. Hill, 1,200 feet, Curtis 2851 (type). Muka Head, Curtis 956. Government Hill 1,200 feet, S.F.N.1546 (Burkill).

var. **aurea** Holtt., **var. nov.** Flores aurantiaci.

Kelantan. Gua Lambok, Sungei Betis, on limestone, S.F.N. 29715 (Henderson). In this specimen the lip is 1 cm. long; this may indicate variability of length of lip in the species.

6. **Globba cernua** Bak. F. B. I. 6: 205. 1890. Ridl. J.S.B.R.A.S. 32: 99. 1891. Flora 4: 240. *G. trachycarpa* Bak., F. B. I. 6: 205. 1890. Ridl. Flora 4: 240. *G. macranthera* Ridl., Journ. F.M.S. Mus. 4: 76. 1909. Flora 4: 240.

Stems c. 50–70 cm. tall to top of highest leaf-sheath; leaves c. 4–7; basal sheaths purple. *Leaf-blade* purple or pale green beneath, to c. 20 by 5 cm., elliptic, rather long-acuminate, base cuneate-decurrent, glabrous or slightly hairy on midrib both above and below or in some mountain plants hairy all over lower surface; *petiole* to c. 4 mm. long; *ligule* broad, glabrous

or with ciliate edge, c. 2 mm. tall; *sheath* glabrous or slightly hairy near the petiole and ligule. *Inflorescence* curved downwards in a broad curve, its apex pointing perpendicularly down; total length from apex of uppermost leaf-sheath 8–20 cm., basal part bearing a few sterile bracts followed by few to many axillary bulbils; rachis of inflorescence proper pale green, 5–10 cm. long, glabrous or rarely short-hairy with rather few branches spaced c. 0·5–1·2 cm. apart. *Primary bracts* rather soon deciduous, pale green, thin, glabrous, broadly ovate, c. 8 mm. long, smaller towards apex of inflorescence. *Branches of inflorescence* slender, glabrous, the lower ones c. 8–12 mm. long to the first flower, bearing a succession of several to many flowers in two close ranks on very short (to 1 mm.) pedicels, ultimately to c. 2 cm. (rarely 2·5 cm.) long. *Calyx* with ovary 5–6 mm. long, the lobes hardly spreading, blunt, two a little longer than the third, glabrous, pale green. Rest of flower very pale yellow, filament nearly white. *Corolla-tube* c. 1 cm. longer than calyx, short-hairy; lobes 5–6 mm. long. *Staminodes* c. 1–1·2 cm. long and 2·5 mm. wide, acute. *Labellum* c. 8 mm. long, with broad rather falcate divergent lobes which hardly reach the attachment of the petals, bearing a 2-lobed olive-brown spot. *Filament* c. 1·5 cm. long beyond the lip; anther bearing two spreading and somewhat divergent narrowly triangular appendages on each side, sometimes (always?) with a small tooth between them. *Fruit* more or less rugose (rarely seen in specimens).

This species is common on the Taiping Hills and the Main Range at c. 2,000–4,000 feet, and has also been collected in the lowlands of Perak. Its southern limit appears to be G. Angsi and its northern limit Taiping. It has never been collected in the lowlands of Pahang. Baker's *G. brachycarpa* (or *trachycarpa*) seems to me indistinguishable from his *G. cernua*; and *G. macrantha* Ridl. is only a form with rather long peduncle bearing many bulbiliferous bracts.

Inflorescences with the first flowers just opening may retain most of their primary bracts; older inflorescences have usually lost them. In old inflorescences there are usually the short pedicels of many fallen flowers. Fruiting seems to be rare.

7. **Globba unifolia** Ridl., J.S.B.R.A.S. 44: 193. 1905. Flora 4: 240.

Stems 10–30 cm. to top of highest leaf-sheaths, bearing 1–4 leaves, their blades all close together near the top of the stem, and several green or reddish bladeless sheaths. *Leaf-blade* (largest) 12 by 3 to 22 by 7 cm. if more than one; if solitary to 20 by 10 cm., apex shortly acuminate, base cuneate and decurrent into the petiole; lower surface sometimes purplish, usually minutely hairy all over, sometimes nearly glabrous; upper surface glabrous; *petiole* of lowest leaves sometimes under 5 mm. long, of uppermost leaves 1·5–3 cm. long, short-hairy to almost glabrous below, like the midrib; *ligule* 1–2 mm. long, short-hairy or nearly glabrous; *sheaths* short-hairy to glabrous. *Inflorescence*

stiffly deflexed; *peduncle* 1–2 cm. long beyond the top of the uppermost leaf-sheath, abruptly deflexed in a short curve, its apex pointing downwards, bearing one or two sterile bracts c. 1·2–1·5 cm. long (usually without axillary bulbils); rachis pointing downwards, 2–5 cm. long, bearing c. 5–15 spreading branches, all minutely hairy. *Primary bracts* persistent, deflexed, thin, ovate, ± fringed with short hairs, the largest c. 1–1·5 cm. long, white (?); *secondary bracts* to c. 6 mm. long, more or less persistent. *Branches* c. 4–7 mm. long to the first secondary bract, when old to 2 cm. long, each bearing up to 10 flowers on pedicels 3–4 mm. long; flowers orange or orange-yellow. *Ovary* rugose; *calyx* with ovary c. 7 mm. long, minutely hairy, teeth blunt, two longer than the 3rd. *Corolla-tube* c. 8 mm. longer than calyx, minutely hairy; lobes c. 5 mm. long. *Staminodes* narrow, acute, c. 7 mm. long. *Labellum* c. 7 mm. long, c. 6 mm. wide near the apex, bilobed, the lobes divergent and slightly reflexed, their apices reaching a little below the point of attachment of the corolla-lobes. *Filament* c. 1·5 cm. long beyond its attachment to labellum; anther less than 3 mm. long, with two spreading narrowly triangular appendages on each side; appendages 3–4 mm. long. *Fruit* rugose, c. 7–8 mm. diameter.

This species is only known to occur in Trengganu and Kelantan. The original collection by Rostados had only one large leaf (blade 20 by 10 cm.) to each stem, for which reason Mr. Ridley gave the name *G. unifolia*. Later collections however have more than one leaf, and there is every gradation from the condition of one large broad leaf to four or even five smaller narrower ones. All agree in the leaves being petioled and close together at the top of the stem, and all have exactly similar inflorescences. Pubescence varies considerably. The size of the inflorescence and of its bracts varies with the size of the plants.

SPECIMENS. *Trengganu.* Bundi, Rostados, July 1902 (Type). Kuala Brang, S.F.N. 15317 (Holttum). Ulu Brang-Tersat, 3,600 feet, S.F.N. 33386 (Moysey). *Kelantan.* Sungei Keteh, Batu Panjang, S.F.N. 12093, (Md. Nur). S. Keteh at Gua Ninek, S.F.N. 19573 (Henderson).

var. sessiliflora Holtt., **var. nov.**

Flores sessiles; bracteae primariae ad 2.5 cm. longae, albae vel carneae; bracteae secundariae mox deciduae; folia ad 29 × 13 cm.

This variety is only known from Kemaman. It perhaps only differs in the sessile flowers, but this distinction seems constant, and length of pedicel is usually fairly constant within a species. In view of their close agreement with typical *G. unifolia* in other respects, I do not think the Kemaman plants can rank as a separate species. Corner made three collections. In one (30716) the plants generally had one leaf and the bracts were rose-pink; in the others (30013, 30090) the plants generally had 2 leaves and the bracts were white or slightly greenish. Other characters

seem the same in both. The flowers were golden-yellow with two confluent dark brown spots on the lip.

Trengganu. Ulu Bendong, Kemaman, 700 feet, S.F.N. 30013 (Corner), common in hillside forest. Kg. Ayer Puteh, Kemaman, low alt., S.F.N. 30716 (Corner), on stream bank along the road to Chukai. Ulu Bendong, Kemaman, 500 feet, S.F.N. 30090 (Corner), very abundant both on hillsides and by streams in swamps.

8. **Globba Curtisii** Holtt., sp. nov.

Caules foliati 50–60 cm. alti, folia 4–6 ferentes, basi vaginis purpureis obtecti. *Lamina* foliі infra purpurea, omnino glabra (vel infra costa hirsuta), ad 13 cm. longa et 3·5 cm. lata, elliptica, apice caudato-acuminata, basi cuneata; *petiolus* nullus vel brevissimus; *ligula* 1 mm. alta, margine plerumque ciliata; *vagina* glabra vel leviter hirsuta. *Inflorescentia* leviter curvata, apice non dependens, 10–15 cm. longa (pedunculo incluso); *pedunculus* bracteas 2–4 bulbiferas 2 cm. longas ferens; *rachis* 2–3 cm. (raro 6 cm.) longa; *bracteae primariae* c. 6, aurantiacae, ad 10 mm. longae et 6 mm. latae, ovatae, tenues, glabrae, persistentes. *Rami inflorescentiae* 4–7 mm. longi infra flores; *flores* 2–4, 2–4 mm. dissiti; *rachis* flexuosa; *pedicelli* 2·5–3 mm. longi. *Calyx* aurantiacus, cum ovario 6–7 mm. longus, infundibulus, lobi subaequales obtusi; *corolla* pallide lutea (vel aurantiaca ?), tubus quam calycem haud 10 mm. longior, lobus dorsalis 7 mm. longus, laterales leviter breviores; *staminodia* c. 11 mm. longa et 3 mm. lata, acuta, pallide lutea; *labellum* aurantiacum maculo brunneo ornatum, 10 mm. longum, bilobum, lobi divergentes et leviter reflexi; *filamentum* 15 mm. longum; *anthera* aurantiaca, 2·5 mm. longa, appendiculis utrinque 2, patentibus, anguste triangularibus, munita. TYPUS: Pahang, Fraser's Hill, 4,000 feet, S.F.N. 33193, leg. Corner, 13.8.1937.

OTHER SPECIMENS. *Selangor.* The Gap, Curtis s.n. May 1902, cult. Penang (with coloured drawing). Gunong Semangkok, 2,000–3,000 feet, Curtis 2755. Semangkok Pass (= The Gap), Ridley s.n. 10.8.1904. 15th mile Pahang Track, Ridley s.n. 1897. Bukit Kutu, Ridley s.n. May 1896 (mixed with *G. aurantiaca*).

This species resembles closely *G. cernua* in its flowers, but has an inflorescence with shorter rachis which is not decurved to a perpendicular position, the lateral branches shorter to the first flower, the flowers fewer, more widely spaced, and on slender pedicels 2.5–3 mm. long, the bracts orange and more persistent, the flowers more richly coloured. It has only been found at or near the Gap (the Pahang Track was the name for the track to the Gap before the road was made) and on Bukit Kutu which is not far away. It will most likely be found at other places on the Main Range. I name it in memory of Charles Curtis, who cultivated it at Penang and evidently recognized it as a distinct species.

The colours given in the description are taken from Corner's field notes. He states "petals pale yellowish" and does not mention the staminodes. Curtis's drawing shows

the petals about the same orange colour as the lip, the staminodes paler.

In colouring *G. Curtisii* resembles *G. aurantiaca*, but the leaves of *G. Curtisii* are much narrower and nearly glabrous, the primary bracts larger, the branching more lax, the pedicels shorter and the staminodes much longer than in *G. aurantiaca*. *G. Curtisii* might possibly be a hybrid between *G. cernua* and *G. aurantiaca* (both of which occur in the same locality), but there is no clear evidence of this, and the specimens are very uniform in character.

9. **Globba aurantiaca** Miq., Fl. Ind. Bat. Suppl. 613. 1860. Ridl., J.S.B.R.A.S. 32: 97. 1899. Flora 4: 239.

Stems c. 60 cm. tall to top of highest leaf-shoot; leaves 3–5. *Leaf-blade* to 19 by 6·5 cm. or to 24 by 10 cm., elliptic, apex shortly abruptly acuminate, base cuneate and decurrent, beneath sometimes purplish and almost always softly hairy, upper surface with short hairs on midrib only or glabrous; ligule and sheath densely hairy, hairs rather fine or soft, to nearly 2 mm. long, (in some specimens hairs short). *Inflorescence* 15–30 cm. long above the uppermost leaf-sheath; peduncle bearing several narrow very hairy not-sheathing sterile bracts (largest 2 cm. long) the upper ones gradually smaller and closer, grading into the primary bracts of the inflorescence, the lowest ones of which often have axillary bulbils only; rachis proper short, 2–3 cm. long, rarely to 10 cm. long. *Primary bracts* orange, 4–5 mm. long, ovate, very hairy with a fringe of hairs; secondary bracts to 3 mm. long, orange, hairy; all bracts persistent. *Branches* of inflorescence close together, 3–4 mm. long to the first secondary bract. *Pedicels* of flowers slender, minutely hairy, c. 4–7 mm. long. *Ovary and calyx* minutely hairy, together 6 mm. long; calyx teeth subequal, all with a spreading sub-apical hollow spur c. 1 mm. long, in two of them this spur acutely pointed, in the third blunt. *Corolla-tube* c. 1·5 cm. long beyond apex of calyx, minutely hairy; lobes spreading, concave, ovate, about 5 mm. long, orange. *Staminodes* little longer than corolla-segments, 2 mm. wide, apex pointed, orange. *Lip* paler golden orange with a rufous-brown spot near the apex, nearly 1 cm. long, the apex rather deeply bilobed, the lobes diverging, their tips just below the level of junction of staminodes and petals. *Filament* extending c. 1·8 cm. beyond the lip; anther 2·5 mm. long with two narrow acute slightly divergent spurs spreading on either side, their bases confluent or occupying the whole length of the anther, colour as lip. *Fruit* sub-globose, smooth, or slightly rugose, c. 8 mm. long.

The plant described by Miquel as *G. aurantiaca* was from S. Sumatra. His description is not very full, and does not mention the anthers, but his plant must have been closely similar to those from Malaya identified by Ridley with *G. aurantiaca*.

This species and *G. variabilis* are undoubtedly very closely related, and the only clear distinction I can see is in the long pedicels of the flowers of *G. aurantiaca*. Plants of *G. aurantiaca* are usually larger and much more hairy than

in *G. variabilis*, but the length and density of hairs is very variable. The leaves are also usually broader, but they are distinctly variable in width. The rugose ovary of *G. variabilis* is also a distinction from *G. aurantiaca* but not always very clearly visible on dried specimens. The sterile bracts on the peduncles of both species are very variable, but always broader in *G. variabilis* and never so hairy as in typical *G. aurantiaca*.

The species is found in lowland and mountain forest (to 4,000 feet altitude) from Penang southwards to Malacca; there are many collections. Few specimens have been found in Johore. Corner has collected the species twice near the S. Sedili and G. Panti, one collection having normal hairy leaves and one with leaves almost glabrous beneath. The only other from Johore is a small-leaved specimen with seven leaves, nearly glabrous, from Ulu Kahang (Holttum, S.F.N. 10927). On Bukit Kutu (Selangor) Ridley found a curious form with leaves which when dry are strongly ribbed above by the rather thick prominent veins, which are also connected by raised transverse veins. From Bukit Tangga (Negri Sembilan) and Selangor have been obtained specimens with rather stiff hairs all over the upper surface of the leaves, rising between the veins on rather thick papillae.

10. **Globba variabilis** Ridl., Trans. Linn. Soc. 3: 378. 1893. J.S.B.R.A.S. 32: 98. 1899. Flora 4: 239. *G. malaccensis* Ridl., J.S.B.R.A.S. 32: 93. 1899. Flora 4: 237. *G. perakensis* Ridl., J.S.B.R.A.S. 32: 98. 1899. Flora 4: 239.

Stems c. 30–45 cm. long to apex of highest leaf-sheath, usually bearing 3–5 leaves, the bladeless basal sheaths green or flushed with purple, usually short-hairy. *Leaf-blade* (largest) about 10 by 3 to 24 by 8·5 cm., apex shortly acuminate, base cuneate-decurrent; lower surface often (always?) purple, minutely hairy throughout or almost glabrous; upper surface dark green, sometimes with short hairs on the midrib; *petiole* sometimes distinct or sometimes hardly so owing to the decurrent lamina, always short, short-hairy on lower surface; *ligule* 3–4 mm. long, edge usually ciliate, otherwise glabrous or very short-hairy; *sheath* often purple, short-hairy at least towards the base of the leaf. *Inflorescence* c. 12–22 cm. long beyond apex of highest leaf-sheath, the axis short-hairy, green or flushed with purple, bearing several more or less hairy green sterile bracts of size decreasing upwards, the longest usually 3 cm. or more long with mucronate-caudate apex. *Rachis* of inflorescence proper usually not over 2 cm. long, with a few crowded branches. *Primary bracts of inflorescence* orange to red, to about 8–9 mm. long, fringed with short hairs, ± persistent. *Branches* of inflorescence deep salmon, minutely hairy, to about 5 mm. long to the first secondary bract, each branch usually bearing a succession of 2–6 flowers close together, with persistent secondary bracts, the longest

branch rarely exceeding 1·5 cm. long in all. Secondary bracts c. 3–6 mm. long, coloured as primary. *Flowers* sessile (no pedicel). *Calyx* with ovary c. 5–6 mm. long, bright orange, teeth about as in *C. aurantiaca*. *Corolla-tube* 1·6–1·8 cm. long beyond mouth of calyx; dorsal lobe 6–7 mm. long, laterals a little shorter, all pale orange-yellow. *Staminodes* about same length as dorsal corolla-lobe, pale orange-yellow. *Labellum* c. 8 mm. long, its apex about level with attachment of corolla-lobes, 2-lobed, the lobes diverging; coloured as staminodes, with a deeper central spot. *Filament* to 2 cm. long beyond attachment to lip; anther shaped as in *G. aurantiaca*, 7 mm. across from tip of one appendage to the other. *Fruit* c. 8 mm. long, more or less rugose.

This species was originally described by Ridley from Pahang. It occurs in lowland forest and at moderate elevations, most commonly in Pahang and Johore, and on the western side of Malaya as far north as Perak, but not to Penang. *G. malaccensis* Ridl. and *G. perakensis* Ridl. seem to me quite identical; the former has 4 anther-spurs, not two as stated by Ridley.

G. variabilis is nearly allied to *G. aurantiaca* but differs in being short-hairy on under sides of leaves and on sheaths, in having broader and less hairy sterile bracts on the peduncle, in sessile flowers and distinctly rugose ovary. The character most easy to observe is the sessile flowers as against the pedicelled flowers of *G. aurantiaca*.

G. atrosanguinea T. and B. from Borneo is nearly allied but seems to be distinct in having much larger primary bracts; *G. deliana* Valet. from Sumatra is probably identical with *G. variabilis*.

TRIBE HEDYCHIEAE.

According to the view here adopted that the primitive Zingiberaceous inflorescence is (*a*) terminal on the leaf-shoot, (*b*) consists of cincinni in the axils of primary bracts and (*c*) has a tubular secondary bract or bracteole at the base of each new branch of a cincinnus, Hedychium is the most primitive genus in this division of the family, being the only one which has all these characters.* It is therefore appropriate to call the tribe Hedychieae; but it is not the same as the Hedychieae of Schumann. Schumann excluded Zingiber, which he placed along with Amomum and Alpinia, whereas its relationship to Scaphochlamys is far nearer. On the other hand, Schumann included Conamomum, which is really a part of Amomum and has no near relationship at all to the Hedychium tribe; and also Odontychium, which is here united to Alpinia, though there is no doubt that it

* Apparently in *H. coronarium* the bracteoles are not tubular; but in all Malayan species examined they are tubular, and in *H. coccineum*.

shows some resemblances to Hedychium and points to the relationship between Hedychium and Alpinia, the primitive members of their respective tribes.

Principal characteristics. The main characteristic of the tribe is the development of the staminodes into petaloid structures, as compared with their rudimentary condition in the Alpinieae. The only genus in which the presence of petaloid staminodes is not at once obvious is Zingiber. Here the staminodes and the labellum are joined together more or less completely into a single 3–lobed structure, the composite nature of which is in nearly all cases clear. This fusion of the staminodes and lip, together with the reduction of the flowers to one in each bract, and the remarkable development of the anther-crest indicate the highly specialized condition of this genus, which is far from typical of the family as a whole.

The other principal common character is perhaps the ellipsoid seed with a deeply lacerate aril, as opposed to the angled seeds with little-lobed aril of the Alpinia tribe.

The various developments of structure as regards rhizome, leaf-shoot, inflorescence etc. within the tribe are discussed in some detail below. Here we may note as perhaps the most characteristic development the reduction of the tall leaf-shoot to a short shoot of few rather erect leaves, and the lengthening of petioles, so that the leaves are usually much taller than the stem proper of the leaf-shoot. The exceptions to this are the primitive genus Hedychium, and curiously enough also Zingiber which is rather highly specialized in other aspects of development. The only genus of the Alpinia tribe which shows a comparable reduction of leaf-shoot and lengthening of petioles is Elettariopsis.

Basis of sub-division of the tribe. Following earlier authors, Schumann attempted to use anther-characters for the main division of the tribe. As Ridley noted, the result is not at all satisfactory; but Ridley did not produce any satisfactory alternative. It is only necessary to see the confusion in Schumann's genera Kaempferia and Gastrochilus to realize how impracticable is his scheme; closely related species are placed in different genera, where they are alongside others to which they show little resemblance. It is true that this is partly due to Schumann's having copied the mistakes of others; but even with full data on all species the result would not be much improved.

It appears to me very clear that here, as in the Alpinia tribe, the main classification must be based on the structure of the inflorescence, which provides really distinctive characters; and the result is undoubtedly a much more

natural grouping than Schumann's. The various types of inflorescence-structure are described below. As in most families of plants, there are exceptional members in some groups, such as *Zingiber Clarkei*, but in the main, inflorescence-characters alone give a satisfactory division.

Anther-characters are probably next in importance. The anther-crest of Zingiber distinguishes it at once; but apart from this case no anther-crest character can be used to separate genera. The basal spurs are probably more important, but in any case are only of use sub-generically.

The character of a unilocular ovary is impossible to use for main divisions of the tribe, as it is very inconstant. In Boesenbergia and Scaphochlamys some species have unilocular and some trilocular ovaries; and in *S. Kunstleri* one plant may have unilocular and another trilocular ovaries. Schumann's genus Haplochorema, as based on this character, is certainly an artificial one, though *H. decus-sylvae* may perhaps remain distinct on account of its peculiar inflorescence.

Rhizome. As in all Zingiberaceae, the rhizome is always a sympodium. Each new branch forms first a greater or longer section of root-bearing rhizome, and then at its apex an erect leaf-bearing or flowering shoot. The rhizome is in all cases subterranean except in some species of Scaphochlamys, where it rises obliquely or even almost vertically, being supported by means of strut-roots (as in some species of Hornstedtia, but on a smaller scale). Such rhizomes are perhaps most common in wet forest where there is a considerable layer of decaying leaves, continually renewed (there is no season of leaf-fall).

Short fleshy rhizomes are commoner in this tribe than in the Alpinieae. They occur especially in Curcuma, Kaempferia and Zingiber; nearly all are aromatic and provide flavourings for human food, or native medicines. From the plant's stand-point, these rhizomes are reserves of food; they have the power of resting and serve to tide the plant over the dry season. Species which produce them can rest leafless for a few months, and so have been able to enter climatic zones denied to the species which are evergreen and need the shade of evergreen forest. Grown in Malaya, Curcumas are evergreen; in the uniform climate of southern Malaya some of them rarely flower. The same remark applies to some of the cultivated Zingibers.

Roots. The roots of most species of Curcuma are fleshy and bear ellipsoid fleshy tubers of varying size. These again are presumably stores of food. They are found also in Kaempferia and rarely in Zingiber. Such root-

tubers are hardly found in the Alpinia tribe. The roots of the epiphytic species of Hedychium are very fleshy throughout, serving probably as water-reservoirs.

Leaf-shoots. Relatively tall erect leaf-shoots with many overlapping sheaths, and short-stalked leaves at a broad angle to the sheaths, are found in Hedychium, Zingiber and Haniffia. These resemble the leaf-shoots of Alpinia, Amomum etc. In the other genera, except to a limited extent in Camptandra and Boesenbergia, the leaf-shoots have a rather short stem, bearing a small group of more erect leaves, often on fairly long petioles, the length of a leaf-sheath being much less than the length of petiole and blade. This gives the plants a very different aspect from those of the Alpinieae. The ligule in some such cases is reduced, but never absent. Whether it develops raised auricles or not is often a useful diagnostic character.

As noted above, each new leaf-shoot (which may or may not have a terminal inflorescence) arises at the apex of a rhizome-element, the origin of which is a bud from a leaf-axil, usually at the base of a previous leaf-shoot. The rhizome-portion of each new shoot bears scale-leaves in two ranks; at the transition from rhizome to erect leaf-shoot the scale-leaves lengthen, forming bladeless sheaths which protect the base of the leaf-shoot; within these arise the foliage leaves, on their longer sheathing bases.

Usually each new element of the sympodium arises in the axil of one of the rhizome scale-leaves, near the transition-point to the erect leaf-shoot. In the case however of those species of Scaphochlamys which bear obliquely ascending rhizomes, the basal scale-bearing part of a new shoot is sometimes very short, and the next bud may arise in the axil of a foliage-leaf. The appearance in such a case is that of axillary branching, and so in a sense it is; but it is not essentially different from those cases in which the new shoot arises in the axil of a scale-leaf of the rhizome. In all cases the new shoot is (potentially at least) a new element of the sympodium. All shoots have limited apical growth, and most of them end in an inflorescence; all are of equal status except in those species where some shoots are solely vegetative and some solely flower-bearing. Valeton and Ridley are therefore wrong when they speak of the inflorescences of some species of Scaphochlamys as "lateral," as distinct from the terminal inflorescence of (for example) *Boesenbergia pandurata*. Every inflorescence of Scaphochlamys is terminal on an element of the sympodium, and all such elements are approximately equal.

In some species of Scaphochlamys (and in *Haplochorema decus-sylvae*) each element of the sympodium has only

one foliage-leaf. In such cases this leaf is preceded by the usual bladeless sheaths, and the sheath of the foliage-leaf imbricates with the innermost of such sheaths to form a protection for the developing inflorescence. Where the successive shoots are close together, the impression of axillary inflorescences may result.

Position of Inflorescence. There is no genus (except Haniffia, of which only two species are known) in which the inflorescence is always on a separate shoot from the foliage leaves. In Curcuma some species have the inflorescence terminal on the leaf-shoot and some have it on a separate shoot. In Zingiber the latter condition predominates but there are occasional exceptions. In Kaempferia a few species have separate inflorescences; these usually develop before the appearance of the leaf-shoots. In Hedychium, Scaphochlamys, Camptandra, Boesenbergia and Roscoea the inflorescence is always terminal on a leaf-shoot.

Structure of Inflorescence. As noted above, only in Hedychium do we find the primitive form of inflorescence, with a cincinnus in the axil of each primary bract and the secondary or flowering bracts of tubular shape. This structure is essentially the same as in Alpinia; but in Hedychium the cincinni remain almost sessile, and the primary bracts are always rather large (rarely so in Alpinia), whereas the large sheaths which in Alpinia enclose the inflorescence to a very late stage are lacking. As in the Alpinieae, the other genera show different modifications of the primitive inflorescence-structure. All of them have lost the tubular form of the secondary bracts.

In *Curcuma* the primary bracts are very broad and imbricating, as in *Hedychium coronarium*, but they are adnate to each other in their basal parts, forming closed pouches, which are not found in any other genus; the apical bracts also are sterile and usually larger and distinctively coloured, forming a *coma*. The cincinni have short axes, as in Hedychium. The flowers in each are arranged in the normal order of an axillary cincinnus (the first secondary bract being at right angles to the primary bract etc.); the secondary bracts are elliptic with inflexed edges, not tubular at the base, and are fairly large.

In *Scaphochlamys* the primary bracts are not so large as in Curcuma, not joined at the base, and sometimes less closely imbricating. There is a range from compact cone-like inflorescences to very lax ones with each bract separately set on a flexuous rachis. Each primary bract is concave at the base and contains a compact cincinnus of several rather small flowers. The secondary or flowering

bracts are arranged as in Curcuma, but the first one is usually much larger than the rest and so arranged that it faces (or almost faces) the primary bract; it has strongly inflexed edges, embracing all the flower-buds of the cincinnus, and often has two well-marked keels, like the palea of a grass. The other secondary bracts are either of descending order of size, or more often all very much smaller than the first one. They are never tubular at the base.

The axillary groups of flowers are true cincinni, the arrangement essentially the same as in Curcuma, but the whole group appears to have been rotated through one right angle so that the opening of the first secondary bract faces the primary bract instead of being at right angles to it. This is of course an advantage in that the overlapping edges of the two bracts make a more efficient protection for the group of flowers than if the second one were in the normal position facing at right angles. It is notable that in several families of Monocotyledons a 2-keeled secondary bract is formed facing the primary bract at the base of a branch of the inflorescence. Perhaps in Scaphochlamys we have a survival of this bract, which has disappeared in some other genera. Bracts of this shape and in a similar position are also found in Heliconia and Marantaceae. The inner bracts of Scaphochlamys have bases which extend over half-way round the axis; their edges in each case just overlap the bud in the axil of the previous bract, which makes that bud at first sight seem very excentric.

In *Camptandra* we have a single primary bract, the axis stopping short just beyond it, and an axillary cincinnus arranged as in Curcuma, not as in Scaphochlamys. (Camptandra also has anther-characters which distinguish it from the other genera).

In the remaining Malayan genera the cincinnus in the axil of each primary bract has been reduced to one flower. In Roscoea and Haniffia there are no secondary bracts; but in the other genera secondary bracts are present.

In *Zingiber* the secondary bract (or bracteole) is shaped exactly as the first secondary bract of Scaphochlamys, and *faces the primary bract* in the same way. This is in marked contrast to such genera as Hornstedtia and Costus, in which the non-tubular secondary bract is at right angles to the primary, at the side of the single flower as one looks towards the axis of the inflorescence. It seems therefore that the ancestor of Zingiber must have had an inflorescence like that of Scaphochlamys. The exceptional species *Z. Clarkei* has a cincinnus of flowers in each bract and probably indicates the ancestral type.

Kaempferia has the same arrangement as in Zingiber, though usually with much fewer primary bracts and an inflorescence-axis that is hardly elongated; but here the secondary bracts are more or less bilobed or even so deeply divided that the halves become separate. Their position and lobing indicates an origin from a 2-keeled secondary bract in the position of that in Scaphochlamys, the bract having become 2-lobed with a keel in each lobe.

There remain Boesenbergia and the dubious genus Haplochorema. Valeton describes the inflorescence of *Haplochorema decus-sylvae* as exactly like that of a Kaempferia with few bracts which are quite enclosed by the sheaths of the foliage leaves, *except* that the apical flower develops first and the lower ones later, in succession downwards, or centripetally away from the apex, instead of the usual reverse arrangement. Whether any other species have this arrangement is unknown. It is remarkable and interesting because it gives a possible origin for the peculiar arrangement of Boesenbergia.

In *Boesenbergia* the development is from apex to base, or centripetal, as in *Haplochorema decus-sylvae*, and in most cases the axis of the inflorescence is short, the whole being enclosed within the imbricating foliage leaf-sheaths; but in Boesenbergia there are more bracts, and they are in two ranks instead of in a spiral. There is one secondary bract facing each primary bract, with inflexed edges as in Zingiber, the secondary bract being nearly as long as the primary. The peculiarity does not stop here; the two rows of bracts are not on exactly opposite sides of the axis, like the two ranked foliage leaves of a Zingiberacea, but both are a little towards one side so that the whole is dorsiventral. How this peculiar dorsiventral 2-ranked arrangement originated is not obvious. It may perhaps have evolved as a development from a few-bracted condition like that of *H. decus-sylvae* by increase in the number of bracts through intercalary basal growth, the added bracts being 2-ranked like the foliage-leaves below them. A possible alternative is development from a single axillary cincinnus by intercalary basal growth; this would give the two rows of bracts in a dorsiventral arrangement, but it would not explain the presence of secondary bracts, because the bracts of a cincinnus are themselves secondary and no bracts or bracteoles of a third order are known in this group of genera. At least we may say that Boesenbergia has the most specialized inflorescence in the Hedychium tribe.

Ovary. The normal ovary in the family is of course trilocular with more or less axile placentation; this is the case in Hedychium, Curcuma, Camptandra and Zingiber.

In Globba (and the related non-Malayan genera) the ovary is apparently always unilocular with parietal placentation. In Boesenbergia it is sometimes unilocular and sometimes trilocular, and the same is apparently true of Scaphochlamys, though further information is needed, the placentation being basal or on a placenta attached at the base of the ovary. In some species of Scaphochlamys the number of ovules is very much reduced, even in *S. erecta* at least sometimes to one, and in *S. Klossii* to three. The genus Haplochorema of Schumann consists perhaps of species of both Boesenbergia and Kaempferia; but *H. decus-sylvae* does not appear to be a typical Kaempferia. Whether any true Kaempferia has a unilocular ovary is doubtful. At least one may say that in the Scaphochlamys group there is a tendency to the reduction of ovules and the formation of a unilocular ovary. In the same way some species of Languas in the Alpinieae have incompletely trilocular ovaries, but the tendency is evidently less strong in Alpinieae than in Hedychieae.

Fruits. The structure of fruits in this tribe has been much less studied than in the Alpinieae. There appear to be no very large or fleshy fruits comparable with those of some species of Amomum. The largest fruits are in Hedychium; these dehisce from apex to base, the three valves diverging and exposing the highly arilled seeds.

Tube of the flower. The tube is slender throughout, except in Curcuma and to a less extent in Scaphochlamys where the upper part widens to a funnel-or cup-shape (the *faux*). In Curcuma there is a raised hairy ring at the base of the faux; in other genera (so far as known to me) hairs without a special ridge, near the mouth of the tube, or none.

Staminodes. The staminodes (representing the two stamens of the outer whorl on either side of the functional stamen) are usually of size comparable with the corolla-lobes. They vary from a long narrow shape in most species of Hedychium to a nearly circular shape in some species of Kaempferia and in Camptandra. They are usually more or less spreading, the extreme position being taken in Kaempferia and Camptandra (where with the two halves of the lip they form an almost quadrate flat flower). In Curcuma they are concave with their inner edges folded under the hood of the dorsal corolla-lobe.

In Zingiber the staminodes are united to the lip to a greater or less extent. They stand erect on either side of the base of the lip, in exactly the same position as the erect side-lobes of the labella of many orchids.

Labellum. Accepting the view of Costerus that the labellum in Zingiberaceae normally represents both two stamens of the inner whorl and also the intervening one of the outer whorl, it appears that in the Hedychieae the single outer stamen is not strongly developed. The labellum in this tribe is nearly always rather deeply 2-lobed, most deeply in Hedychium, Camptandra and Kaempferia, least (or hardly at all) in Curcuma and Boesenbergia. There is often however some indication of the presence of the middle stamen in the tooth in the sinus of the lip (e.g. *Hedychium longicornutum*). Valeton reports a statement by Costerus that in the labellum of Zingiber the median vein representing the vascular bundle of the middle stamen is quite lacking. One can say at least that in the Hedychieae there is a much greater tendency to deep bilobing of the lip than in the Alpinieae; or alternatively that in the Alpinieae the middle stamen is usually more strongly developed.

As regards colour of the lip, the greatest uniformity is found in Curcuma and Scaphochlamys, in all species of which the general colour is white with a median yellow band, sometimes bordered with purple or violet with or without a few radiating purple or violet lines. This is exactly the same arrangement as occurs in some species of Alpinia and in Elettariopsis, and must surely represent an ancestral character reaching far back into the history of the family. The same yellow band is usually found in Boesenbergia, though often there accompanied by a good deal of red colour in other parts of the lip; in Kaempferia it is often found at the base of the lip only. It does not appear in Zingiber, which has either very pale-coloured labella, or a general mottling of pink or deep purple-violet.

Stamen. The length of the filament varies much more than in the Alpinieae. In Hedychium and Globba it is very long; in Zingiber, Kaempferia and Camptandra so short that it hardly exists; in Curcuma it is as broad as long.

The pollen-sacs of the anther normally dehisce by longitudinal slits, as usual in the family as a whole, but a few species of Boesenbergia (*B. Curtisii*) have apical pores instead of slits. This is certainly not a generic character, as species closely allied in all other respects have the two different methods of dehiscence. In Scaphochlamys the basal ends of the pollen-sacs are prolonged as short free tips. In Camptandra (and apparently also in Roscoea) the pollen-sacs are much produced basally into sterile appendages which are inclined forwards away from the filament, thus giving a versatile character to the anther.

In Curcuma also the anther is versatile, being attached usually about the middle of the pollen-sacs, and at the same

time there is usually a sterile out-growth from the back of the base of each pollen-sac. These outgrowths are usually called spurs, and they function in the same way as the basal appendages in Camptandra as a mechanism for cross-pollination. A visiting insect pushes against the spurs on entering the flower, and in so doing brings the pollen-sacs into contact with its back.

The connective of the anther develops an apical crest of conspicuous size in most species of Scaphochlamys and Kaempferia, but not so large as in many members of the Alpinieae. A small crest is also found in some species of Boesenbergia. In Camptandra, which is in many ways closely related to Kaempferia, there is no crest. The most remarkable development is in Zingiber, where the crest is usually about as long as the anther and as wide, with inflexed sides which entirely enclose the style except near its apex. The crest is also curved towards the lip, and so arranged that it brings the stigma close to the middle of the lip, well in front of the pollen-sacs. Zingiber is the only case in the whole family in which the anther-crest alone gives a distinctive generic character; in all other cases there are exceptions, which have caused much confusion in systems of classification based on the anther-crest.

KEY TO THE GENERA OF THE HEDYCHIUM TRIBE

Staminodes and lip joined to form a single more or less deeply 3-lobed organ; anther prolonged into a long narrow crest with inflexed edges enfolding the style 1. *Zingiber*.

Staminodes free from lip; anther-crest, if present, not enfolding the style

Bracts adnate laterally for about half their length, forming closed basal pouches, each containing a cincinnus of a few flowers 2. *Curcuma*.

Bracts not adnate laterally

Inflorescence terminal on a leafy shoot

Filament at least half as long as lip and usually much longer 3. *Hedychium*.

Filament much shorter than half the length of the lip

Several flowers in the axil of each bract

One bract only (or rarely 2), apparently terminal 4. *Camptandra*.

Several to many bracts 5. *Scaphochlamys*.

One flower in the axil of each bract, with one or two bracteoles

Bracts 2-ranked, the apical one developing first; bracteoles about as long as bracts, lip hardly bilobed
6. *Boesenbergia.*

Bracts not 2-ranked, lowest developing first; bracteoles usually much shorter than bracts; lip deeply bilobed

Bracteoles more or less deeply 2-lobed; rhizome short and fleshy
7. *Kaempferia*

Bracteoles not 2-lobed; rhizome creeping, slender
Scaphochlamys biloba.

Inflorescence on a separate shoot

Inflorescence and leaf-shoot appearing at separate times; each flower with one 2-lobed bracteole 7. *Kaempferia.*

Inflorescence appearing simultaneously with the leaf shoot; no bracteoles 8. *Haniffia.*

1. ZINGIBER Adanson

Rhizome at or near surface of ground, bearing leaf-shoots close together. *Leafy shoots* short to moderately tall, often with many leaves. *Leaves* thin in texture, never very large (rarely to 50 cm. long), sessile or with quite short petioles, the ligule short to long, deeply bilobed or entire. *Inflorescence* on a separate shoot without normal leaves (in a few non-Malayan species at the apex of the leaf-shoot) ; scape usually erect, short or long, clothed with 2-ranked sheaths which are sometimes coloured red; spike short or long, slender to thick, cylindric, ovoid or tapering to a narrow apex, elongating gradually. *Bracts* fairly large, usually brightly coloured, red or yellow, usually thinly fleshy, closely imbricating or with apices free, margins plane or inflexed. *One flower* in the axil of each bract; flowers fragile, short-lived. *Bracteoles* one to each flower facing the bract, thin, narrower than the bract, usually persisting and enclosing the fruit, split to the base, never tubular. *Calyx* thin, tubular-spathaceous, usually shorter than the bracteole but sometimes longer. *Corolla-tube* slender, usually about as long as the bract; dorsal lobe usually broader than the others, erect, narrowed to the tip and hardly hooded, edges inflexed, lateral lobes usually

below the lip and on either side of it, sometimes joined partly together by their adjacent sides and to the lip, colour usually white or cream. *Labellum* deeply 3-lobed (the side-lobes representing the staminodes) or rarely the side-lobes hardly free from the midlobe, side-lobes erect on either side of the stamen, midlobe shorter than or not greatly longer than the lateral corolla-lobes, its apex usually retuse or cleft; colour cream to white, or more or less deeply suffused with crimson or purple, in a few cases very dark purple. *Filament* of stamen short and broad; anther rather long, narrow; connective prolonged into a slender curved beak-like appendage as long as the pollen-sacs, with inflexed edges, containing the upper part of the style. *Stigma* protruding just below the apex of the appendage, not thickened, with a circular apical aperture surrounded by stiff hairs. *Stylodes* usually slender and free, not surrounding the base of the style. *Ovary* glabrous or hairy, trilocular with several ovules in each loculus. *Fruit* with a fleshy wall when fresh, more or less leathery when dry, smooth or hairy, enclosed by the persistent bract and bracteole, dehiscent loculicidally within the persistent bracts. *Seeds* ellipsoid, black or dark brown, covered by a thin saccate white aril with irregularly lacerate edges.

The genus Zingiber is distributed throughout tropical S.E. Asia and Malaysia, and to Queensland and Japan. The only species extensively used as a flavouring for food is the true ginger, *Z. officinale*, but *Z. zerumbet* and *Z. cassummar* are well known village plants much used in native medicine, and probably *Z. Ottensii* also. As regards native species, it is difficult at present to give a satisfactory account of them, as the data available are insufficient. This is largely because the flowers of Zingiber are so fragile and short-lived that in many cases none have been preserved, or the preservation is very unsatisfactory; and field-notes of colour are very incomplete. It is therefore impossible to separate with certainty specimens of closely allied species, and for a proper understanding of the *Z. gracile* group we must wait for further field study in many parts of Malaya.

The main distinguishing features of the genus are the long curved anther-appendage embracing the style, the 3-lobed lip (the side-lobes being the staminodes, which are relatively broad and fused more or less to the mid-lobe or lip proper), and the relatively large bracts, each with a single flower and a non-tubular bracteole, more or less imbricating on a lengthening inflorescence. (There is one aberrant species, *Z. Clarkei* from Sikkim, which has 2–4 flowers to each bract). The bracts are often, but not always, coloured; in some species they change colour as they

grow older. The colour of the lip is an important distinguishing character; in some species it is cream or white, in others suffused more or less completely with pink, crimson or purple. The bracts nearly always hold much water, which becomes more or less mucilaginous, and the flowers and fruit develop in this medium, the fruit dehiscing while still enclosed by the bracts.

The best account of the genus is by Valeton (in *Bull. Btzg.* 2nd Ser. XXVII: 118). He states that the shape of the lip of all species in Java is very characteristic; but unfortunately we have not yet full information on this character for all Malayan species. The relative length of bracteole and calyx, and the fruit characters, are also important but in many cases unknown. Valeton has also some remarks on the homologies of the lip and staminodes; he inclines to the view that the lip proper in Zingiber represents the two inner stamens the outer one being completely abortive.

The group of species which are difficult to discriminate are *Z. gracile*, *Z. Griffithii* and *Z. puberulum*. These have been much confused, and I am by no means satisfied that the present account clears up the confusion. I have reckoned three varieties of *Z. gracile* besides the typical form, and it is likely that these may later rank as distinct species; in the absence of full details however I think it better not to attempt to separate them at present. There seems no clear line of distinction between *Z. Griffithii* and *Z. gracile*, though typical specimens of the former, with their broad finely ribbed leaves and broader inflorescences are very distinct. *Z. gracile* seems on the whole to be a northern and *Z. Griffithii* a southern species; it is especially the specimens from Selangor which seem intermediate, which may indicate hybridization in the zone of contact of the two. In the same way, *Z. gracile* var. *petiolata* approaches *Z. puberulum* in its large vegetative size, and large tough bracts. The variation in size of the ligule in *Z. gracile* is also remarkable; in some other species it appears much more constant.

ZINGIBER: KEY TO MALAYAN SPP.

Bracts with their apical margins incurved; or with their apices curved outwards and free, not closely imbricating; labellum mottled purplish or pinkish and cream

Apices of bracts narrowed to a blunt point and curved outwards

Inflorescence to about 14 cm. long and 9 cm. wide; leaves to about 45 by 6 cm. 1. *Z. Kunstleri.*

Inflorescence to about 9 cm. long and 6 cm. wide; leaves to about 30 by 10 cm. 2. *Z. Wrayi.*

Apices of bracts not curved outwards, rounded with incurved margins

Leafy stem slender, 60–100 cm. tall, largest leaves to 20 cm. long

Leaves under 2 cm. wide 3. *Z. officinale.*

Leaves 4 cm. or more wide

Labellum closely blotched with purple throughout (including side-lobes); bracts about 3–3·5 cm. long and 1·5 cm. wide 4. *Z. Curtisii.*

Labellum with almost entirely crimson mid-lobe and white side-lobes; bracts about 2·7 by 2·4 cm. 5. *Z. chrysostachys.*

Leafy stems thicker, to 150 cm. or more tall; leaves commonly 30 cm. or more long

Inflorescence 12–30 cm. tall, cylindric, bracts with their ends free, forming open pouches 6. *Z. spectabile.*

Inflorescence not usually over 12 cm. long, ellipsoid; bracts with apices touching those next above, not gaping to form pouches

Labellum pale pink and pale yellow; village plant 7. *Z. Ottensii.*

Labellum dull purple speckled with cream; mountain plant 8. *Z. multibracteatum.*

Inflorescence evenly ovoid to fusiform or cylindric, the bracts closely overlapping, their apices not incurved; labellum cream or white, without mottling

Leaves about 20–30 cm. long and 2–3 cm. wide

Village plant; not wild; inflorescence 3–3·5 cm. wide, bracts brownish green 9. *Z. cassumunar.*

Forest plant; inflorescence hardly more than 2 cm. wide at flowering, bracts red or red-purple 13. *Z. gracile* var. *elatior.*

Leaves proportionately wider

Bracts of inflorescence green when young, red when old; ligules 1·5–2·5 cm. long, very thin 10. *Z. zerumbet.*

Bracts purple, red, orange or yellow when young, the yellow ones sometimes changing to red when old

Leaves 15 by 3 to 30 by 10 cm., the principal veins raised on the surface, giving a ribbed appearance 11. *Z. griffithii.*

Leaves proportionately narrower, upper surface smooth

Inflorescence ovoid, not pointed at apex 12. *Z. puberulum var. ovoideum.*

Inflorescence pointed at apex

Inflorescence more than 2 cm. (to 4 cm.) wide at the base, tapering to a pointed apex; bracts with broadly rounded apex 12. *Z. puberulum.*

Inflorescence narrowly fusiform or cylindric, to about 2 cm. wide; bracts narrowed to the apex 13. *Z. gracile.*

Leaves to about 18 by 4 cm., ligule c. 1·5 cm. long *typical form.*

Leaves larger, ligule shorter

Bracts bright orange turning red when old; inflorescence to about 20 cm. long; petioles short var. *aurantiaca.*

Bracts rose-pink; inflorescence to 45 cm. long; petioles 0·5–1·5 cm. long var. *petiolata.*

1. **Zingiber Kunstleri** King apud Ridl., J.S.B.R.A.S. 32: 127. 1899. Flora 4: 258.

Stems 2 m. tall; colour of base of stems and rhizomes when cut purplish-lilac; bases of stems slightly swollen, pale lilac. *Leaves* many, close, thin, to 45 by 6 cm., apex very gradually and evenly narrowed to a long point, base also gradually narrowed, cuneate, glabrous; petiole under 5 mm. long; ligule 2-lobed, the lobes broadly rounded, thin, glabrous, about 4 mm. long. *Scape* about 30 cm. long; sheaths up to 8 cm. long, glabrous except near tips. *Inflorescence* ovoid, to about 14 cm. long including the bracts and 9 cm. wide, the rachis about 9 cm. long. *Bracts* pink, about 6 cm. long, the lowest ones 3 cm. wide, rest about 2 cm. wide, almost evenly elliptical, hairy near base and apex, apex narrowed, bluntly pointed, curved outwards or deflexed. *Bracteole* nearly 5 cm. long. *Calyx* shorter than bracteole. *Corolla-lobes* apparently about 3·5 cm. long, pale. *Labellum* not much wider than corolla-lobes, not lobed (?) reddish and brown. *Appendage* as long as anther.

This species was described by Ridley from a drawing and field notes by Kunstler. The drawing has the appearance of being made from a dried specimen and it is quite likely that the lip is incorrectly shown. Two further collections agreeing in leaves and inflorescence have been made, and from them the dimensions of leaves and bracts have been taken. The rhizome colour is taken from Corner's notes.

SPECIMENS. *Perak.* 2,000–2,500 feet Kunstler 2219 (drawing only). Taiping Hills, Ridley 11449. *Trengganu.* Ulu Kajang, Kemaman, in swamp, 500 feet, S.F.N. 30588 (Corner). In addition, a specimen from near Sungei Teku, Pahang (foot of G. Tahan) may belong to this species, but is small, the leaves to 28 by 4 cm., the scape 24 cm. long, bracts about 4 cm. long; the inflorescence is immature, of total length 6 cm., the bracts pink (leg. Kiah, s.n. 29.7.1936).

2. **Zingiber Wrayi** Prain ex Ridl., J.S.B.R.A.S. 41: 32. 1904. Flora 4: 259.

Leafy stems to 2 m. tall, pinkish at base. *Leaves* to about 30 by 10 cm., almost evenly elliptic, shortly acuminate-caudate, base cuneate, glabrous; petiole hardly over 2 mm. long; ligule deeply 2-lobed, lobes thin, broadly rounded, to 5 mm. long, glabrous or bearing a few hairs. *Scapes* 7–30 cm. long; sheaths to 6 cm. long, hairy near tips. *Inflorescence* ovoid, to about 9 cm. long (rachis to 6 cm.) and 6 cm. wide. *Bracts* red, about 4·2 cm. long and 1·8–2 cm. wide (lowest to 2·5 cm. wide), almost evenly elliptic, the apex shortly pointed, fleshy, short-hairy, with slightly inflexed edges. *Bracteoles* 4 cm. long, acute, narrow, short-appressed-hairy, tinged with pink. *Calyx* with ovary about 2·8 cm. long, deeply split down one side. *Corolla-tube* about 3 mm. longer than bracteole; lobes about 2·1 cm. long, acute, edges slightly inflexed towards the tip, pale yellow, the dorsal one more than 1 cm. wide near the base, laterals narrower, side by side beneath the lip (not joined). *Lip* pale yellow mottled and irregularly veined with dark purple, about as long as corolla-lobes, 3-lobed; midlobe ovate with slightly crisped edges, the apex hardly retuse, equal to about ¾ total length of the lip, side-lobes rounded, erect on either side of anther, hardly 1 cm. from base of lip to apex of side-lobes, 6 cm. from junction with midlobe to apex. *Filament* very short; pollen-sacs nearly 1·5 cm. long, appendage about 8 mm., dark purple, curved. *Stylodes* 7 mm. long. *Fruit* not seen.

The species was described by Ridley from a specimen collected in Upper Perak by Wray. The inflorescence is similar to that of *Z. Kunstleri* but smaller; the leaves are broader. The flower is described as "pale yellow, the lip spotted and marked with purple." Corner collected ample material in Johore of plants agreeing in leaf and inflorescence with Wray's plant, with flowers of similar colouring; I think there can be no doubt that these Johore plants are *Z. Wrayi* and have drawn the above description from them. Corner reports that the flowers open at 4 p.m.

Z. Wrayi is most nearly related to *Z. inflexum* Bl. (see *Ic. Bog.* 2: t. 172) but apparently has wider leaves with shorter petioles, much narrower bracts and flowers of different colour. It is also related to *Z. gramineum* but very different from that species in its wider leaves.

SPECIMENS. *Perak.* Upper Perak, 300 feet, Wray 3735. *Pahang.* Bukit Bayoh, P. Tioman, S.F.N. 18569 (Md. Nur). *Johore.* Bukit Tinjau Laut (near S. Sedili), S.F.N. 37054 (Corner). *Trengganu.* Ulu Brang, 300 feet, S.F.N. 33712 (Moysey).

3. Z. **officinale** Rosc., Tr. Linn. Soc. 8: 348. 1807. Valeton, Bull. Buitenz. 2nd Ser. XXVII: 128. 1918.

Rhizome entirely pale yellowish within or with a red external layer. *Leafy stems* to about 50 cm. tall, 5 mm. diameter, glabrous except for short hairs near base of each leaf-blade; *leaf-blades* commonly about 17 by 1·8 cm., rather dark green, narrowed evenly to slender tip; *ligule* broad, thin, glabrous, to 5 mm. tall, slightly bilobed. *Scape* slender, to 12 cm. tall, the upper sheaths with or without short leafy tips; *inflorescence* c. 4·5 cm. long and 15 mm. diameter; *bracts* c. 2·5 by 1·8 cm., green with pale submarginal band and narrow translucent margin; margins incurved, lower bracts with slender white tip. *Bracteole* as long as bract; *calyx* with ovary 12 mm. long; *corolla* tube 2·5 cm. long; lobes yellowish, dorsal lobe 18 by 8 mm. (flattened), curving over the anther and narrowed to the tip, laterals narrower. *Lip* (midlobe) nearly circular, c. 12 mm. long and wide, dull purple with cream blotches and base, side-lobes about 6 by 4 mm., free almost to the base, coloured as midlobe; *anther* cream, 9 mm. long, appendage dark purple, curved, 7 mm. long.

Distribution: cultivated in tropical Asia from ancient times (country of origin unknown), and now throughout the tropics. It grows well in the lowlands of Malaya, but rarely flowers. There are at least three local races: *Halia bĕtul* or true ginger, *Halia bara* or *Halia padi*, and *Halia udang*. The first has no red colour in the rhizome; the others are red externally and very pungent, used medicinally only.

In its narrow leaves *Z. officinale* resembles *Z. cassumunar*, but the latter has much taller leafy stems with lighter green leaves and may be distinguished by its very short hairy ligules.

4. **Zingiber Curtisii** Holtt., **sp. nov.**

Caules foliati eis *Z. chrysostachydis* similes; *scapus* ad 10 cm. longus vel ultra, vaginis purpureis obtectus; *inflorescentia* ad 14 cm. longa et 3 cm. lata, fere cylindrica, apice obtusa; *bracteae* pallide luteo-virides, 3–3·5 cm. longae, 1·5 cm. latae, fere ellipticae, apice obtusae et leviter inflexae, glabrae (vel subglabrae), tenues; *bracteolae* quam bracteas leviter breviores; *calyx* cum ovario c. 2 cm. longus; *corollae* tubus bracteolam leviter superans, lobi c. 2 cm. longi, albi; *labellum*

lobis corollae haud aequilongum, album vel pallide lutescens, omnino (lobis lateralibus inclusis) dense purpureo-maculatum, forma labello *Z. chrysostachydis* simile; *antherae* crista atropurpurea. TYPUS: Bujong Malacca, cult. in hort. bot. Penang., leg. Curtis August 1898, cum icone colorata.

This species is not distinguishable vegetatively from *Z. chrysostachys*. The inflorescence seems to be rather longer and more slender, the bracts only slightly inflexed at the tips and forming a closer spike, a pale green-yellow, longer and narrower, the lip with deep purple markings throughout, and the anther-appendage deep purple. Only the original collection is known. It is possible that this should rank as a variety of *Z. chrysostachys*.

5. **Zingiber chrysostachys** Ridl. J.S.B.R.A.S. 32: 129. 1899. Flora 4: 260.

Stems about 60–100 cm. tall, slender, the lower sheaths flushed with purple. *Leaves* dark green, sessile, the largest 12 by 4 to 17 by 5·5 cm., ovate-elliptic, shortly acuminate, the base rather broadly cuneate, glabrous except for the hairy base of the lower surface of the midrib; ligule thin, hairy towards the base, broad with a somewhat retuse apex, 4–5 mm. long. *Scape* 7–15 cm. long; sheaths purple, 2·5–3·5 cm. long, the apex broadly rounded with a thin margin, slightly hairy. *Inflorescence* to about 10 cm. long and 4 cm. wide, ellipsoid, blunt, the bracts loosely imbricating, convex near the top, with inflexed upper margin. *Bracts* yellow, about 2·7 cm. long and 2·4 cm. wide, obovate, rather sparsely hairy, with thin edges. *Bracteoles* 2·5 cm. long. *Calyx* with ovary about 1·4 cm. long. *Corolla-tube* 6 mm. longer than calyx; lobes white, about 2·5 cm. long, the dorsal one 9 mm. wide. *Labellum* as long as corolla-lobes, 3-lobed; midlobe almost entirely crimson with irregular white markings, nearly round, slightly retuse; side-lobes white, much smaller, ovate with blunt points, spreading laterally much more than the width of the midlobe when flattened. *Appendage of anther* pink-spotted.

This species has been collected several times in Perak and Kedah, in the low country and at medium elevations on the hills. In its inflexed bracts and red-marked lip it appears to be related to *Z. spectabile* and *Z. Ottensii* but is a very much smaller species than either. No other small local species has bracts of this character. In *Z. chrysostachys* they are yellow, contrasting with the purple sheaths of the scape and the white and crimson flower. The dimensions above are from dried specimens.

SPECIMENS. *Perak.* Maxwell's Hill Ridley 5199; do., 3,000 feet, Curtis 2716. Upper Perak, 300 feet, Wray 3549 (erroneously cited by Valeton as *Z. littorale* Val.). The Cottage, Taiping, Hervey s.n. 1889. Grik, S.F.N. 13830 (Burkill and Haniff). *Kedah.* G. Bongsu Forest Reserve, S.F.N. 35834 (Nauen).

6. **Zingiber spectabile** Griff., Notul. 3: 414. 1853. Ridl., J.S.B.R.A.S. 32: 128. 1899. Flora 4: 258.

Rhizome just below ground surface, bearing leafy stems close together. *Leafy stems* about 2 m. tall, distinctly flattened, basal leafless part to nearly 1 m. tall, green; lowest leaves well spaced, uppermost crowded, narrow. *Largest leaves* 30–50 by 6–10 cm., glabrous or slightly hairy at the base beneath, thin, apex acuminate, base rounded to cuneate (rather narrowly cuneate in upper leaves); no petiole; ligule very thin, glabrous, deeply 2-lobed, the lobes broad, pale green, scarious when old, each lobe to 1·5 cm. long and wide. *Scape* 30–50 cm. long, sheaths broad, to about 5 cm. long, green or slightly reddish. *Inflorescence* 12–30 cm. tall, 6–7 (–10) cm. wide, cylindric, not tapering to the apex. *Bracts* at first yellow, sometimes suffused with pink at the edges, when old entirely red, about 4·5 cm. long and wide, obovate, thinly fleshy, curved outwards, with the broadly rounded distal edge stiffly incurved, the tips forming open pouches, the bases closely overlapping so that they hold much water. *Bracteole* about 4 cm. long, split to the base but quite folded round the tube of the flower, very shortly and unequally 2-lobed. *Ovary* minutely hairy, 5 mm. long at flowering. *Calyx* with ovary about 2·7–3 cm. long, glabrous, thin, the apex broad and slightly 3-lobed, split deeply down the other side, pink or cream. *Corolla-tube* 3 cm. long; lobes 2·7 cm. long, pale yellow, acute, the edges inflexed towards the tip, the dorsal one 1·7 cm. wide near the base, the laterals 6 mm. wide, near their bases adnate to the lip and joined to each other by their adjacent edges. *Labellum* in all 2·5 cm. long and as wide when flattened, midlobe 1·6 cm. long and 1·4 cm. wide, ovate, the apex cleft to a depth of 2·5 mm.; side-lobes (staminodes) erect on either side of the stamen, broadly rounded and slightly bilobed, about 1 cm. wide, all lobes dull dark purple with many small pale yellow spots, the throat yellow with the fine purple flecks. *Filament* none; anther 1·5 cm. long to apex of pollen-sacs, yellow, prolongation of connective curved, 1·5 cm. long, dark purple. *Stylodes* slender, 1·2 cm. long, acute, free to base, not surrounding the style. *Stigma* not dilated, aperture small, round, fringed with hairs, white. *Fruit* about 2·5 cm. long, ellipsoid, covered with the bracteole; *seeds* up to 6 in each loculus, black when ripe, ellipsoid, 6 mm. long, covered 2/3 from base by a white aril with fimbriate or lobed edge.

This handsome species is found throughout Malaya from Negri Sembilan northwards. It has the largest inflorescence of any Malayan species. *Z. macradenium* K. Schum. from Sumatra (see Val., Ic. Bog. 2: t. 173) is almost if not quite identical; it differs in longer bracteoles and corolla-tube (both 5·5 cm.), shorter, broader inflorescence with somewhat larger bracts and usually smaller leaves, but agrees exactly in shape and colour of flowers. Both Corner and Burkill report that the flowers open about 10 a.m.

7. **Zingiber Ottensii** Valeton, Bull. Buitenz. 2nd Ser. XXVII: 137, t. 19. 1918. Ridl., Flora 4: 259.

Rhizome dark purple within. *Stems* close together, about 1·5 m. tall, bearing many leaves. *Leaves* commonly to 35 by 6 cm., sometimes to 40 by 8 cm., slightly hairy on the back

towards the base, elliptical or widest above the middle, the apex acuminate, the base cuneate to rounded; *petiole* under 5 mm. long, hairy; *ligule* broad, thin, undivided, to about 1.2 cm. long, hairy towards the base. *Scape* 25–40 cm. tall; sheaths broad, 5–7 cm. long, slightly hairy near base and apex. *Inflorescence* about 10 cm. long and 4·5 cm. wide, evenly ellipsoid with broad apex, the bracts closely imbricating, not gaping. *Bracts* almost 4 cm. long and nearly as wide, widening slightly from a broad base to a very broad almost truncate apex, convex on the outside with the middle part of the apical edge incurved; the edges very thin for a width of 2–3 mm. and slightly hairy; colour of bracts at first dull reddish, when old bright red. *Bracteoles* c. 3·2 cm. long, 1·6 cm. wide when flattened (Valeton—those seen are narrower). *Calyx* with ovary about 2·3 cm. long, glabrous. *Corolla-tube* 3·5 cm. long, lobes very pale yellowish; dorsal lobe erect, narrowed to the tip, c. 2·2 cm. long and 1·1 cm. wide near the base, 7-nerved; lateral lobes about 2 cm. long and 6 mm. wide, 3-nerved, joined together in basal part. *Labellum* faint yellow mottled with pink, in all about 2·5 cm. long, 3-lobed almost to the base, the midlobe about 2 cm. long and 1·5 cm. wide, the apex rounded and slightly bilobed; side-lobes (staminodes) erect on either side of dorsal corolla-lobe, rounded, about 1·5 by 0·9 cm. *Anther* 1·2 cm. long, appendage about 1 cm. *Stylodes* 8 mm. long, narrowed to a slender tip.

Native names: Lĕmpoyang Hitam; Bonglai Hitam.

Distribution: Malaya, Java, Sumatra.

This species was described by Valeton, who noted the remarkable dark purplish colour of the rhizome (whence the names Lĕmpoyang or Bonglai Hitam, in contrast to the yellow rhizome of *Z. zerumbet* and *Z. cassumunar*). Ridley at first confused it with *Z. zerumbet* which it resembles in general appearance, but *Z. zerumbet* has a more pointed inflorescence with the apex of the bracts not convex-incurved, and a clear pale yellow flower without the pink markings of *Z. Ottensii*. The colour of the lip of *Z. Ottensii* is variously described as pale yellow mottled with pink, or pink mottled with yellow.

Z. Ottensii is a village plant, the rhizome being used medicinally; whether truly wild in Malaya is uncertain. The rhizome has a very pungent smell.

SPECIMENS. *Kedah.* Yan, Ridley s.n. June 1893. *Penang.* Government Hill, cult. at Residency, October 1901. Cult. in Waterfall Gardens, Curtis 1200. Tulloh Bahang, Curtis s.n. Ap. 1900. *Trengganu.* K. Trengganu, S.F.N. 17671 (Holttum). *Selangor.* K. Selangor, Ridley 7799.

8. **Zingiber multibracteatum** Holtt., **sp. nov. Fig. 2 A.**

Caules foliati ad 3 m. alti, conferti, virides; *lamina folii* atroviridis, tenuiter carnosa, subtus capillis sericeis (saltem in juventute) vestita, ad 40 cm. longa et 10 cm. lata, fere elliptica, apice breviter caudata, basi cuneata; *petiolus* nullus; *ligula* c. 4 mm. alta, dense hirsuta; *vagina* prope laminam et basis costae dense hirsutae; *scapus* validus, ad 60 cm. longus, vaginis 5–8 cm. longis, non imbricatis, apicem et basin versus hirsutis

donatus; *inflorescentia* ovoidea, compacta, ad 12 cm. longa et 6 cm. diametro, bracteis multis figurata; *bracteae* confertae, imbricatae, leviter convexae, marginibus non inflexis, 3·5–4 cm. longae, 2–3 cm. latae (superiores basalibus angustiores), obovatae, apice late rotundatae, margine tenuissima scariosa c. 1·5 mm. lata, in sicco tenues, basin versus solum sericeae, fusco-purpureae; *bracteolae* 3–3·5 cm. longae, 1·3 cm. latae, glabrae, tenues; *calyx* cum ovario 3 cm. longus; ovarium hirsutum; *corollae* tubus fere 5 cm. longus, lobi 3 cm. longi, pellucidi, pallidissime rubicundi, lobus dorsalis apice colore nitentior, lobi laterales basin versus adnati; *labellum* atropurpureum maculis parvis albis, praesertim prope margines, ornatum, quam lobos corollae leviter brevius; *lobi laterales* late rotundati, e basi labello 1·5 cm. longi, sinus inter lobos laterales et lobum intermedium brevis; *lobus intermedius* rotundatus, marginibus inflexis, apice retusus; *anthera* (thecae) fere 1·5 cm. longa, crista aequilonga; *stylodia* tenuia, 6 mm. longa. TYPUS: Pahang, Fraser's Hill, 4,000 feet, S.F.N. 33174, leg. Corner, 12.8.1937.

This species has been collected three times at Fraser's Hill, where Corner says it is common, and at Cameron Highlands. It is characterized by the very broad ovoid inflorescences of many dull purple closely imbricating convex firm rounded bracts with thin edges, and the large flowers with purple white-spotted lip. Vegetatively it is very near *Z. puberulum*, but in inflorescence and colour of labellum is clearly allied to *Z. spectabile* and *Z. Ottensii*. Ridley's specimen no. 9820 from Bujong Malacca, named by him *Z. Griffithii* var. *major* is very near but has a more tapering inflorescence and the colour of the flowers is not recorded. *Z. multibracteatum* is apparently near *Z. odoriferum* Bl. of Java, but has shorter broader inflorescences, shorter bracts and longer bracteoles (see Ic. Bog. 2: t. 175).

OTHER SPECIMENS. *Fraser's Hill.* S.F.N. 8666 (Burkill and Holttum). Without number, Mrs. Ferguson-Davie. Sungei Yet, 3,700 feet, S.F.N. 11095 (Md. Nur). *Cameron Highlands.* Boh Plantations, 4,000 feet, S.F.N. 32869 (Md. Nur).

var. viride Holtt., **var. nov.**

Bracteae virides, ad 5 cm. latae; bracteolae ad 2·4 cm. latae. Cameron Highlands, Tanah Rata, Aug. 1946 (Holttum).

This appears to agree in all essential characters with the Fraser's Hill type except those mentioned.

9. **Zingiber cassumunar** Roxb., Asiat. Res. 347, t. 5. 1810. Fl. Ind. 1: 49. Bot. Mag. t. 1426. K. Schum., Pflanzenr. Zingib. 179. Valet. Bull. Buitenz. 2nd Ser. XXVII: 138, t. 15, f. 13, t. 20, f. 14, 15. Ridl. Flora 4: 259.

Rhizome pale carrot-colour internally, strongly aromatic. *Stems* usually 1·2–1·5 m. tall, sometimes to 2 m. *Leaves* close together, sessile, largest 20–35 cm. long, 2–4 cm. wide, glabrous except the lower surface of the midrib towards the base, evenly narrowed to the tip, more broadly to the base; ligule hairy,

2-lobed, about 2 mm. long; sheath glabrous or hairy on edges near the ligule. *Scape* 18–25 cm. long. *Inflorescence* 10–16 cm. long, 3–3·5 cm. wide, fusiform or cylindric-ovate, acute. *Lowest bracts* almost round, middle ones acute, 3–3·5 cm. long, brownish green with pale edges, more or less hairy on the exposed parts, the edge thin. *Corolla* pale yellow. *Labellum* pale yellow, in all 2–3 cm. long, 1·8–2·5 cm. wide, the midlobe almost round, retuse at the apex when newly expanded, deeply split when old; side-lobes (staminodes) much smaller, when flattened not extending more widely than the midlobe, ovate. *Native names:* Bonglai, Bolai.

This species is said to be native in India; it occurs widely in Malaysia as a village plant which is used medicinally, but is probably not native. In Malaya it is well known to the Malays, always by the name *Bonglai*, or some variant of it, to distinguish it from *Lĕmpoyang* (*Z. zerumbet*). Among herbarium specimens, none has an inflorescence, from which one may conclude that the species does not flower often in Malaya. The description given above is taken from Valeton. Plants can be distinguished from *Z. zerumbet* by their much narrower leaves and very short ligules. The only Malayan specimens quoted by Ridley were collected by Curtis in Penang; they appear to me to be *Z. zerumbet*, not this species.

10. **Zingiber zerumbet** (L.) Sm., Exot. Bot. 2: 103, t. 112. 1804. Bot. Mag. t. 2000. Valet. Bull. Buitenz. 2nd Ser. XXVII: 129, pl. 16, f. 1–3; pl. 15, f. 3. Ridl., J.S.B.R.A.S. 32: 127, p.p. *Amomum zerumbet* L., Spec. Pl. ed. 1, 1. 1753. *Zingiber spurium* Koenig; Retz. Obs. 3: 60. 1783. *Zingiber aromaticum* quoad Ridl., Flora 4: 259, p.p. **Fig. 3.**

Rhizome pale yellowish internally; root-tubers present. *Stems* 1 to nearly 2 m. tall (including leaves). *Leaves* thin, ± hairy beneath and sometimes purplish beneath on young shoots (always?), 25–35 cm. long and 5–8 cm. wide, midrib strongly raised on lower surface, the apex rather short, acuminate, gradually narrowed towards the base; petiole 0–6 mm. long, finely hairy; *ligule* very thin, translucent, entire, broad 1·5–2·5 cm. long, finely hairy towards the base. *Scape* 15–45 cm. tall; sheaths to 5 cm. long, broad, green, the backs short-hairy, the apex rounded with a thin edge and short tip, not overlapping. *Inflorescence* 6–12 cm. long and 4–5 cm. wide, ovoid to ellipsoid, tapering to the apex but not acute, green when young, red when old (red first on edges of bracts). *Bracts* about 3–3·5 cm. long and to 2·5 cm. wide, slightly convex near upper edge, the apex broadly rounded with a thin pale slightly hairy margin about 2 mm. wide, the tip with a very short appressed point, the outer surface sometimes sparsely hairy. *Bracteole* 2·5 cm. long, c. 1·3 cm. wide, thin but persistent to fruiting. *Corolla* tube about as long as bract; lobes white or very pale yellowish, the dorsal lobe to 2·5 cm. long and nearly 2 cm. wide, the laterals narrower. *Labellum:* midlobe to about 2·0 by 2·0 cm., nearly round with the apex cleft about 5 mm., the edges somewhat crisped,

coloured as petals or a deeper yellow towards the base; side-lobes (staminodes) much smaller, ovate, entire, about 1·3 cm. long from base of lip to tip of lobe, separate almost to base from midlobe. *Stamen* as long as the lip, the appendage shorter than the anther. *Fruit* white, thin-walled, glabrous, dehiscent, about 1·5 cm. long. *Seeds* ellipsoid, black, 6 mm. long, covered with white lacerate aril.

This species was originally described from Ceylon. It is widely cultivated in S.E. Asia and somewhat variable in size. In his account of 1899, Ridley confused it with *Z. Ottensii* and perhaps also with *Z. aromaticum*; but there is no clear evidence beyond Ridley's statement "lip pale yellow with central orange bar" that *Z. aromaticum* in Valeton's sense occurs in Malaya. Under *Z. zerumbet* I include plants with flowers described as white and also as pale lemon yellow. The species is perhaps not native in Malaya, but is found round villages and in secondary growth. There are few herbarium specimens. *Z. zerumbet* is usually known as *Lĕmpoyang* to Malays. It is used medicinally, not as food.

11. **Zingiber Griffithii** Bak., F.B. I. 6: 246. 1892. Ridl., J.S.B.R.A.S. 32: 131. 1899. Flora 4: 260. *Z. citrinum* Ridl., J.S.B.R.A.S. 32: 129. 1899. Flora 4: 260.

Leafy shoots 25–70 cm. (more?) to top of sheath of uppermost leaf, glabrous. *Leaves* about 15 by 5 to 30 by 10 cm., evenly elliptic or widest above the middle, apex rather shortly pointed, base broadly to narrowly cuneate, principal veins distinctly raised above when dry, giving a finely ribbed appearance, very finely appressed-hairy below, both on surface and on midrib; petiole very short, more or less hairy; ligule thin, glabrous or hairy, broad, 2-lobed. *Scape* 5–15 cm. long, the sheaths to 3·5 cm. long, finely hairy. *Inflorescence* up to about 20 cm. long, 2½–4 cm. wide, fusiform when young, when old nearly evenly cylindric except for the slightly tapered blunt apex. *Bracts* pink to red, or yellow turning red when old, thinly fleshy (not tough) when living, thin when dry and often with many small dark spots (spots not visible when living), 3–5 cm. long or rather more, 2–4 cm. wide, the apex very broadly pointed with a very short hairy tip, glabrous or with very fine silky hairs towards the base. *Bracteole* apparently lacking. *Calyx* with ovary 2 cm., ovary densely hairy. *Corolla* tube slender, about 3 cm. long; lobes 1·8 cm. long, white to cream, dorsal lobe 10 mm. wide, laterals joined together for nearly half their length below the lip. *Labellum* same colour as petals or yellower, the side-lobes ovate with rounded tips, midlobe more triangular, the apex acute to subacute, sometimes cleft. *Anther* c. 1·1 cm., appendage 9 mm. long. *Fruit* 22 mm. long, flattened.

This species is fairly common in lowland forest in the southern half of Malaya and occurs as far north as the Dindings. It is well characterized by its broad leaves with fine raised veins (when dry) and very fine silky hairs beneath. The bracts are thin, much less tough than in *Z.*

puberulum and thinner also than in *Z. gracile*, the inflorescence being more nearly cylindric than in either of these species and broader than in *Z. gracile*. The bracts appear sometimes to be entirely red from the beginning, sometimes red at the base of the inflorescence, the apical ones being yellow, sometimes all are said to be bright yellow; but of the yellow-bracted form (which he called *Z. citrinum*), Ridley stated that the old bracts were pink. There is a fair amount of variation in the size of the leaves, Ridley's *Z. citrinum* having a few large leaves on a short stem; but it seems very doubtful whether this character is always associated with yellow bracts.

Burkill's 5988 from Klang has leaves only 4 cm. wide but otherwise is like this species. There is similar specimen of Ridley's from Petaling (s.n. 1899).

12. **Zingiber puberulum** Ridl., J.S.B.R.A.S. 32: 131. 1899. Flora 4: 261. *Z. Griffithii* var. *major* Ridl., J.S.B.R.A.S. 32: 132. 1899. Flora 4: 261. **Fig. 2, B-J.**

Stems 1–3 m. tall, slightly flattened; leaves many. *Leaves* 25–40 cm. long, 5–8 cm. wide (perhaps sometimes larger), evenly elliptic or widest above the middle, apex acuminate, base cuneate, edges hairy, upper surface hairy near base only, rather gray-green, lower surface sometimes hairy throughout densely so on midrib towards the base, the hairs soft and yellowish-brown, 1 mm. or more long; no petiole; ligule not bilobed, 3–6 mm. long, densely yellow-hairy; sheaths more or less densely hairy (usually covered with a yellowish fur). *Scape* 12–30 cm. or more long, hairy; sheaths 4–7 cm. long, usually densely hairy. *Inflorescence* to 20 cm. or more long, 3–4 cm. wide at base, tapering upwards except when old, bracts closely imbricating. *Lowest bracts* 4–6 cm. long and 2–3 cm. wide; upper ones rather smaller; narrowly obovate, apex broadly rounded with a scarious edge about 1·5 cm. wide, more or less hairy, the edge always yellow-hairy when young, colour bright pink; texture firm (subcoriaceous when dry). *Bracteole* 1·2–1·5 cm. long, very thin. *Calyx* with ovary, 2·5 cm. long: ovary hairy. *Corolla* tube 4·5 cm. or more long; lobes white to cream (sometimes pinkish?), 2·5–3·3 cm. long, the two lateral ones adnate to each other and to the lip near their bases. *Labellum* nearly as long as corolla-lobes, cream to yellowish, the midlobe about 1·8 by 1·4 cm., triangular with rounded tip, not cleft; the side-lobes reaching nearly half the total length of the lip, with short bluntly triangular free ends, when flattened spreading much wider than the midlobe (total width c. 2·5 cm.). *Anther* yellowish, with a crimson line down each side. *Stylodes* 6 mm. long, yellow, blunt. *Fruit* 2–2·5 cm. long, white, dehiscing while enveloped in mucilage: seeds 7 mm. long, black, with white aril ¾ their length.

This is a common species in the forests of southern Malaya, and very variable, especially in hairiness and size of bracts. The stems are always fairly tall and the leaves large for a Zingiber; they are almost always hairy on the ligule and sheaths at least. The inflorescence is always

slender, tapering much to the apex except when quite old; the bracts are closely imbricating, with a rounded apex and thin edge which is usually conspicuously hairy. The colour of the bracts is typically pink; but in the var. *chryseum* (see below) yellowish. The type of the species was found by Ridley in Singapore, and was taken from a plant with smaller leaves than usual (25 cm. long). This species is rather similar in habit and variability to *Z. odoriferum* in Java (see Valeton, Bull. Btzg. 2nd Ser. XXVII: 143); but *Z. odoriferum* has a dark purple lip with yellow spots and a short bracteole.

SPECIMENS. *Singapore.* Bukit Timah, Ridley s.n. June 1894; J.G. s.n. 1889. Serangoon Road, Ridley 4613, and s.n. 1892. Bajau, Ridley, s.n. 1892. Chau Chu Kang, Ridley s.n.; J.S.G. s.n. Ap. 1890. *Johore.* G. Pulai, Ridley s.n. December 1909. Serom, Ridley s.n. 1900. Tanjong Kopang, Ridley s.n. 1894. Pengkalan Raja, Pontian, S.F.N. 36608 (Corner and Henderson). G. Panti, S.F.N. 30969 (Corner), frequent by streams. 14th mile Mawai-Jemaluang Road, S.F.N. 31477 (Corner). Between G. Blumut and G. Berchuak, 2,300 feet, S.F.N. 10842 (Holttum). *Pahang.* Base of G. Senyum, S.F.N. 22380 (Henderson). Bukit Chintamani, Raub, S.F.N. 25003 (Henderson). *Trengganu.* Ulu Ayam swamp, Kemaman, S.F.N. 30266 (Corner). Ulu Bendong, Kajang, 500 feet, S.F.N. 30112 (Corner). *Perak.* Larut, 300 feet, King's Collector 2163 (doubtful). *Selangor.* Ulu Gombak 1,000 feet, Md. Nur s.n. 24.10.1937. *Penang.* Govt. Hill 1,800 feet, Curtis 3037.

var. **chryseum** (Ridl.) Holtt., **stat. nov.** *Zingiber chryseum* Ridl., J.S.B.R.A.S. 50: 149. 1908. Flora 4: 260.

Differs from the typical form of the species in having pale yellowish bracts and in the whole plant being almost glabrous.

The type of this also was collected in Singapore, and was a large plant. In size and shape of leaves and inflorescence it does not differ in any way from normal *Z. puberulum*, and the flowers are described in almost the same terms by Ridley. Whether the yellow bracts and general glabrous character of the plant are always associated is not known. Corner collected a yellow-bracted plant on G. Panti; this has the vegetative parts almost glabrous, and the sheaths and bracts of the inflorescence slightly hairy —less so than in normal *Z. puberulum*. He reported that the leaves were up to 60 by 10 cm., the scape with inflorescence to 80 cm. tall, the bracts "pale dingy buff, greenish towards tip and edge."

SPECIMENS. *Singapore.* Stagmount, Ridley 13330 (type). *Johore.* Ulu Segun, G. Panti, 200–600 feet, S.F.N. 30658 (Corner); common by the stream and on the bank among quartzite boulders.

var. ovoideum Holtt., **var. nov.**

Scapus 5–10 cm. longus; inflorescentia ovoidea, c. 8 cm. longa, apice non acuta.

This variety has been collected chiefly in Pahang. It is rarely if ever so hairy as the typical form, but otherwise is indistinguishable vegetatively. The short ovoid inflorescence with rounded apex seems to be constant. It is possible that the Perak specimen is not the same as the others; it has more bracts, of smaller size.

SPECIMENS. *Pahang.* Tembeling, S.F.N. 21781, 21857 (Henderson). River Tahan, Ridley s.n. August 1891. Gua Tipus, Chigar Perah, S.F.N. 22554 (Henderson). *Kelantan.* Gua Panjang at Gua Ninik, S.F.N. 19566 (Henderson). *Perak.* Road to Bruas near Lumut, Dindings, Ridley s.n. 1897.

13. **Zingiber gracile** Jack, Mal. Misc. 1: 1. 1828. Bak., F.B. I. 6: 246. 2892. Ridl., J.S.B.R.A.S. 32: 130. 1899. Flora 4: 260.

Leafy stems 1 to 2·5 m. tall, basal sheaths reddish. *Leaves* usually widest below the middle and tapering very gradually to the apex, base cuneate, upper surface smooth, slightly and finely hairy on the midrib towards the base only or sometimes on lower surface also; petiole to about 3 mm. long except in var. *petiolata;* ligule 0·3–1·5 cm. long, glabrous or slightly hairy, ± 2-lobed. *Scape* slender; sheaths 3·5–5 cm. long, crimson to purple, short-hairy towards base. *Inflorescence* narrowly fusiform to cylindric, about 1·5–2 cm. diameter at flowering, wider when fruiting, the apex tapering. *Bracts* bright pink to crimson, or orange when young, *closely imbricating,* thin, finely hairy towards base only; *edge barely 1 mm. wide,* thin and scarious; *3·5–4·5* cm. long (to 7 cm. in var. *petiolata*), the lower ones 2 cm. wide, upper narrower, *narrowly ovate, the apex narrowed and bluntly pointed. Bracteole* shorter than calyx. *Calyx* with ovary about 3 cm. long; ovary glabrous. *Corolla-tube* about as long as bract; lobes cream, about 1·5–2 cm. long. *Labellum* cream ¾ length of corolla-lobes, the midlobe broadly oblong with somewhat retuse apex, the side-lobes much smaller, rounded. *Anther*-appendage much curved and bent obliquely to one side (always?). *Fruits* glabrous, thin-walled, with longitudinal ribs, about 2 cm. long and 1·2 cm. wide; seeds about 8 mm. long and 4 mm. wide, ellipsoid.

Typical form: *stems* to 1 m. tall; *leaves* to about 18 by 4 cm. (exceptionally to 25 cm.), lower surface slightly hairy; *ligule* about 1·5 cm. long, very thin; *scape* to 20 cm., *inflorescence* to 20 cm. long; *bracts* and *sheaths* of scape bright pink to crimson; *bracteoles* 1·8 cm. long, thin. This is the form that corresponds to Jack's original description.

SPECIMENS. *Penang.* Stone Quarry, Waterfall, Curtis s.n. May 1890. Without locality, Ridley s.n. Ap. 1896. Telok Bahang, Fox 12708. *Perak.* Bruas, Ridley 7235. *Selangor.* Kanching F.R., Foxworthy and Burkill s.n. November 1921. Kuala Lumpur, Curtis s.n. February 1890. Ginting Bidai, Ridley 7798. *Pahang.* Beserah, S.F.N. 16141 (Burkill and Haniff).

var. aurantiacum Holtt., **var. nov.**

Bracteae primo aurantiacae, demum rubescentes; inflorescentia ad 20 cm. longa; petioli breves.

Stems to 2 m. tall; *leaves* to 35 by 6 cm.; *ligule* to about 6 mm.; *scape* to 35 cm., *inflorescence* to 20 cm. long; *sheaths of scape* purple; *bracts* bright orange turning red when old [fruits described from S.F.N. 8808 and 8863].

SPECIMENS. *Pahang.* Fraser's Hill, S.F.N. 8806, 8808, 8633 (Burkill and Holttum); S.F.N. 33191 (Corner). G. Tahan, 3300 feet, Wray and Robinson 5,365; 3,500 feet, S.F.N. 8016 (Haniff and Nur). *Negri Sembilan.* G. Tampin, S.F.N. 3162 (Burkill). *Selangor.* Ginting Simpah 2,000 feet, S.F.N. 34284 (Md. Nur). Bukit Etam, Kelsall 1978.

This variety seems to be common at moderate elevations on the southern part of the Main Range. There are several fruiting specimens.

var. elatior Ridl., J.S.B.R.A.S. 32: 130. 1899. Flora 4: 260.

Stems about 1·5 m. tall. *Leaves* dark green, sessile, 20–30 cm. long, 2–3 cm. wide, finely hairy towards base beneath; ligule 2–10 mm. long. *Bracts* red-purple. *Bracteoles* 2·5 cm. long, rather stiff. *Lip* with scattered short red and black lines.

The plants included here may well represent a distinct species, as suggested by Ridley. Whether the lip always has the small red and black lines (reported only by Burkill for S.F.N. 3312) is unknown. The very narrow leaves suggest *Z. cassumunar.* Specimens are:

Penang. Richmond Pool, 2,500 feet, Ridley 9340. Moniot's Road, 2,200 feet, S.F.N. 3312 (Burkill). Tiger Hill, S.F.N. 1529 (Burkill). Government Hill 2,500 feet, Fox s.n. August 1899. *Perak.* Batang Padang district, 300–500 feet, King's Coll. 7954. Maxwell's Hill, 3,600 feet, S.F.N. 12712 (Burkill and Haniff); Ridley s.n. June 1893. *Selangor.* Semangkok Pass, Ridley s.n. August 1904. Ginting Simpah, Hume 8717 (Herb. F.M.S. Mus.). *Johore.* G. Pulai, Ridley s.n. December 1905.

var. petiolatum Holtt., **var. nov.**

Bracteae roseae; inflorescentia ad 45 cm. longa; petioli 0·5–1·5 cm. longi.

Stems to 2·5 m. tall, basal sheaths flushed with red-brown, swollen base pale yellowish; *leaves* dark green, to c. 40 by 8 cm., nearly glabrous; petiole 5–15 mm. long; ligule 3–5 mm. *Scape* to 75 cm. tall, sheaths red-brown; *inflorescence* to 45 cm. long, bracts rose-pink, to 7 cm. long; bracteoles to 3 cm. long.

The type of this variety is Corner's collection from Kedah (S.F.N. 31570). This has longer inflorescences with longer bracts than the others, but apart from this there seems little difference. The bracts are very firm when dry. Ridley's Tahan River specimen has small inflorescenses.

SPECIMENS. *Kedah.* Pass to Baling from Kroh, 1,000 feet, S.F.N. 31570 (Corner). *Pahang.* Tembeling, S.F.N. 21794 (Henderson); Ridley s.n. August, 1891 and 30.9.1893. Tahan River, Ridley s.n. 1891.

Doubtful specimens. There are some specimens which seem intermediate between *Z. gracile* and *Z. Griffithii* in

both leaf and bract characters; the leaves are proportionately narrower than in *Z. Griffithii* and less smooth than in *Z. gracile;* the bracts are broader at the apex than in *Z. gracile* but the inflorescence is more slender than normal for that species. The above characters are variously accentuated in different specimens. Specimens are:

Selangor. Jalan Pokok Terap, K. Lumpur, Ridley s.n. May 1890. Sungei Lalang F.R., Symington 22750. 10th mile from K.L., Ridley s.n. 21.6.1889. Petaling, Ridley s.n. 1889. Telok Reserve, Klang, S.F.N. 5988 (Burkill). *Malacca.* Bukit Besar (Mt. Ophir), Ridley s.n. 1899. Mt. Ophir, Hullett s.n. April 1888. *Pahang.* Ulu Sungei Tekal Besar, Temerloh, Henderson 10749.

2. CURCUMA LINNAEUS

Rhizome a fleshy complex, the base of each aerial stem consisting of an erect ovoid or ellipsoid structure (primary tuber) ringed with the bases of old scale leaves, bearing when mature several to many horizontal or curved rhizomes, which are again branched. *Roots* fleshy, many of them bearing ellipsoid tubers. *Leaf-shoots* bearing a group of leaves surrounded by bladeless sheaths, the leaf-sheaths forming a pseudo-stem; total height of leafy shoots 1–2 metres. *Leaf-blades* usually more or less erect, often with a purple-flushed strip on either side of the midrib; size and proportional width varying from the outermost to the innermost (uppermost) leaf. *Petioles* of outermost leaves short or none, of inner leaves fairly long, channelled. *Ligule* forming a narrow upgrowth across the base of the petiole, its ends joined to the thin edges of the sheath, the ends in most species simply decurrent, in two species raised as prominent auricles. *Inflorescence* either terminal on the leaf-shoot, the scape enclosed by the leaf-sheaths; *or* on a separate shoot from the base of the leaf-shoot, the scape covered by rather large bladeless sheaths. *Bracts* large, very broad, each joined to those adjacent to it for about half of its length, the basal parts thus forming closed pockets, the free ends more or less spreading, the whole forming a cylindric spike; uppermost bracts usually larger than the rest and differently coloured, a few of them sterile (the group is called a *coma*). *Flowers* in cincinni of 2 to 7, each cincinnus in the axil of a bract. *Bracteoles* thin, elliptic with the sides inflexed, each one at right angles to the last, quite enclosing the buds but not tubular at the base. *Calyx* short, unequally toothed and split nearly half way down one side. *Corolla-tube + staminal tube* tubular at the base, the upper half cup-shaped, the corolla-lobes inserted on the edges of the cup, and the lip, staminodes and stamen just above them. *Corolla-lobes* thin, translucent white or pink

to purplish, the dorsal one hooded and ending in a hollow hairy point. *Staminodes* elliptic-oblong, their inner edges folded under the hood of the dorsal petal. *Labellum* obovate, consisting of a thickened yellow middle band which points straight forwards or is somewhat reflexed, its tip slightly cleft, and thinner pale (white to pale yellow) side-lobes upcurved and overlapping the staminodes. *Filament* of stamen short and broad, constricted at the top, anther versatile, the filament joined to its back, the pollen-sacs parallel, with usually a curved spur at the base of each; connective sometimes produced at the apex into a small crest. *Stylodes* cylindrical, 4–8 mm. long. *Ovary* trilocular; *fruit* ellipsoid, thin-walled, dehiscing and liberating the seeds in the mucilage of the bract-pouch; *seeds* ellipsoid, with a lacerate aril of few segments which are free to the base.

KEY TO CURCUMA SPECIES FOUND IN MALAYA.

Anther without spurs at the base; ligule-lobes auriculate
- Coma-bracts pink; flowers orange — 1. *C. aurantiaca.*
- Coma-bracts white; lip purple-mauve — 2. *C. parviflora.*

Anther with spurs at the base; ligule not auriculate
- Inflorescence terminal on the leaf-shoot
  - Coma-bracts pale greenish to white; flowers not longer than bracts
    - Flowers white; leaves commonly 30 by 7–8 cm. — 3. *C. domestica.*
    - Flowers cream; leaves commonly much larger — 4. *C. viridiflora.*
  - Coma-bracts purple; flowers conspicuously longer than bracts — 5. *C. colorata.*
- Inflorescence separate from leaf-shoot
  - Leaves quite green — 6. *C. mangga.*
  - Leaves with a feather-shaped purplish cloud on either side of midrib, throughout or towards apex only
    - Purplish cloud in distal half of leaf only; rhizome bluish within — 7. *C. aeruginosa.*
    - Purplish cloud extending to base or nearly so; rhizome internally yellow or orange
      - Petals white; rhizome internally light yellow — 8. *C. zeodaria.*
      - Petals pink; rhizome internally deep orange — 9. *C. xanthorhiza.*

The genus Curcuma, as regards species wild and cultivated in Java, has been very thoroughly studied by Valeton, who has published an extensive report upon it. This report is the basis of the present abridged account, and the reader

is referred for further details to Valeton's excellent paper. The natural distribution of the species is impossible to assess accurately, as many are more or less cultivated village-plants, used in native medicine and in some cases as food. Such species establish themselves in waste ground, and in Java especially in the teak-forests, where they are evidently more abundant than in any places in Malaya. In Malaya several are well-known village-plants, and these are briefly described below. The only two which may be wild are found in the extreme north. These are *C. aurantiaca* and *C. parviflora*, which belong to Valeton's subgenus Paracurcuma, having the anthers without spurs and the ligules strongly auricled.

The characteristic features of the genus, as pointed out by Valeton, are the adnate broad bracts, with a cincinnus of several flowers in the pouch of each, the bracteoles, and the versatile anthers. In the subgenus Eu-Curcuma, comprising all the cultivated species, the divergent basal spurs of the anther are characteristic, as well as the trumpet-shape of the flowers, the segments of which all overlap closely.

The genus is confined to the Indo-Malaysian region.

1. **Curcuma aurantiaca** van Zijp., Rec. Trav. Bot. Néerl. 12: 345. 1915. Valet., Bull. Btzg. 2nd Ser. XXVII: 76, pl. 2 f. 9–13, pl. 3 f. 14–19, 27–29.

   Rhizome not elongated, consisting of a group of short tubers. *Leaves* about 5; blade to about 23 by 10 cm., base rounded, apex shortly acuminate; entirely green; *petiole* about 6–8 cm. long; *ligule* of two raised and rounded lobes about 5 mm. high; *sheath* to about 12 cm. long. *Inflorescence* from the middle of the tuft of leaves; scape about 12 cm. long, slender, spike about 12 cm. long and to 4·5 cm. wide. *Sterile upper bracts* pink, rest usually green. *Bracts* about 3 cm. long, the pouches about the same length as the free distal part, apex very broadly rounded and slightly tipped. *Flower* orange-yellow; corolla-lobes short-hairy outside. *Staminodes* less folded than in *C. zeodaria*. *Anther* attached to the filament about ¼ above the base, the base broad, not bilobed; apex prolonged into a short rounded crest hooded over the stigma.

This is the commonest species of Curcuma in Java, and has been fully described and illustrated by Valeton. It has not hitherto been reported outside of Java, but a specimen collected by Henderson in Perlis (at Besih Hangat, in banana plantation, S.F.N. 22869) and plants from the same locality subsequently cultivated in Singapore (flowers in alcohol) agree closely with Valeton's description. This is evidently another case of a species which needs a seasonal climate and is unable to spread into the south of Malaya.

2. **Curcuma parviflora** Wall., Pl. Asiat. Rar. 1: 47, t. 57. 1830. Schum., Pflanzenr. Zingib. 102. 1904. Valet., Bull. Buitenz. 2nd Ser. XXVII: 7.

Leaves about 4; *blade* to 20 by 7 cm. (usually shorter?), widest above the middle, apex shortly acuminate, base rounded; *petiole* c. 10 cm. long; *ligule* of two rounded erect auricles; *sheath* to about 15 cm. long. *Inflorescence* apical on the leaf-shoot; peduncle hidden by the leaf-sheaths; Spike c. 8 cm. long and 2 cm. diameter. *Bracts* joined for about half their length; sterile upper bracts white with free ends c. 2 cm. long and 1·8 cm. wide, somewhat spreading; fertile bracts shorter and narrower, their free ends hardly spreading, nearly erect, rounded. *Corolla* white; lobes about 7 mm. long. *Staminodes* white, similar in size to the corolla-lobes. *Lip* violet-purple, more or less marked with white. *Anther* shaped as in *C. aurantiaca*.

This species was originally found at Prome in Burma and later in Siam. A plant brought by Henderson from Perlis and cultivated in Singapore proved on flowering to be *C. parviflora*, Perlis representing probably the southern limit of distribution. The leaves of the cultivated plants are longer than normal and proportionately narrow (25 by 7 cm.) ; the size given by Schumann is 14 by 5–7 cm.

3. **Curcuma domestica** Valet., Bull. Buitenz. 2nd Ser. XXVII: 31. 1918. Ridl. Flora 4: 264. *Curcuma longa* Koenig. in Retz. Obs. 3: 71. 1783, *non Linn.* Gagnep. in Fl. Gen. Indoch. 6: 13. K. Schum., Pflanzenr. Zingib. 108. **Fig. 4.**

Primary tuber ellipsoid, c. 5 by 2·5 cm., emitting very many rhizomes 5–8 cm. long, 1·5 cm. thick, straight or a little curved, bearing secondary branches at right angles in two rows, also tertiary branches, the whole forming a dense clump; colour inside and outside orange, the young tips white (when dried dull yellowish outside) : *root-tubers* to 4 by 2 cm. *Height of leafy stem* over all hardly over 1 metre. *Leaf-blade* rarely over 50 cm. long, usually to 30 by 7–8 cm., wholly green. *Petiole* thin, rather abruptly broadened to the sheath. *Ligule*-lobes small (1 mm.) ; *sheath* near ligules with ciliate edges. *Inflorescence* apical on the leaf-shoot, 10–15 cm. long, 5–7 cm. wide. *Coma-bracts* white or white streaked with green, grading to light green bracts lower down; bracts adnate for less than half their length, elliptic-lanceolate, acute, length 5 to 6 cm. *Bracteoles* to 3·5 cm. long. *Flowers* 5–5·5 cm. long; petals white, staminodes and lip creamy-white with yellow median band on the lip. *Filament* united to anther about the middle of the pollen-sacs; spurs very large, broad, diverging, a little curved with the thin apex always recurved outwards.

This species is very widely cultivated in Indo-Malaysia, and known to Malays as *Kunyit*. The rhizomes are used to colour rice and as a spice, and sometimes for dying cloth, though the colour is fugitive. It seems that in Indo-china a variety with pink tips to the coma-bracts occurs. The native country of the species is not certainly known.

Valeton has shown that the *Curcuma longa* of Linnaeus, based solely on Hermann, is not this species; and it is not even certain that *C. longa* of Koenig is the true Kunyit, though this is probable. As however the name *C. longa* belongs to another species, a new name was needed for this one, and Valeton proposed *C. domestica*.

4. **Curcuma viridiflora** Roxb., Fl. Ind. 1: 34. 1820. Valet., Bull. Buitenz. Ser. 2, XXVII: 37.

Rhizome as in *C. colorata*. *Leaves* entirely green, or very faintly purplish in groove of midrib; ligule V-shaped, very short; blade to 60 by 17 cm. *Inflorescence* from top of leaf-shoot, to 17 cm. long with coma 10 cm. wide; *coma* white and pale green, tips a little purple-spotted; *floral bracts* adnate about half their length, blade 3 cm. wide; *bracteole* over 3 cm. long; *flowers* a little shorter than bracts, cream, with yellow median band on the lip and very faintly pink petals; spurs of anthers nearly as long as anther, slightly diverging at tips.

Originally described from a plant found at Benkoelen in Sumatra. A rhizome obtained in Singapore, and classed by a local Malay expert as *Temu Lawas*, on being planted produced a plant very nearly corresponding to Valeton's description of *C. viridiflora*; it is actually a little intermediate between *C. domestica* and *C. viridiflora*.

5. **Curcuma colorata** Val., Bull. Btzg, 2nd Ser. XXVII: 40, t. 25; t. 5, f. 1. 1918.

Rhizome externally light dull orange, inside orange; smell pleasant, taste mild, rather carrot-like; young buds nearly white; old main tuber 8 cm. tall, 3·5 cm. wide near base; branches mainly from near base, under 2 cm. thick, all curved upwards and bearing secondary and tertiary branches also curved upwards, especially on the lower side; scale-leaves soon disappearing and their bases not distinct; roots not fleshy (nor tuber-bearing ?). *Leaf-shoot* to more than 100 cm. tall, with about 7 leaves. *Lowest leaf-blade* 21 by 9·5 cm., petiole 2 cm., sheath 19 cm. *Highest leaf-blade* 54 by 13·5 cm., petiole 22 cm., sheath 35 cm. Base of blade unequal; tip shortly caudate (to 2 cm.); midrib purple in groove only on upper surface, a slight flush of purple on each side of lower surface of midrib, purple fading from old leaves. *Ligule* very short, of two small low auricles within the hollow of the base of the petiole. *Inflorescence* terminal on leaf-shoot; scape enclosed by leaf-sheaths; spike to 16 cm. tall, the coma to 10 cm. diameter, rest 7 cm. diameter. *Coma-bracts* purple; bracts next below white or light green with purple stripes, rest light green with purple tips; bracts adnate 1/2–2/3 of their length, lower bracts in all 4·5 cm. long, coma-bracts to 7 cm. *Flowers* 5–6 cm. long, protruding a good deal above the bracts; corolla-lobes very pale pink, staminodes and lip pale orange with deeper orange median band in the lip.

This species is reported by Valeton to grow spontaneously in teak forests in all parts of Java; it has no well-established native name and is not regularly used like the other species. It has not been reported in Malaya, but

a plant has flowered in Singapore Botanic Gardens; the plant was sent from Serdang Agricultural Experiment Station as *C. purpurascens*. The origin of the plants at Serdang is unknown; they may have come from Java. On the other hand, this species may occur in Malay villages. When the rhizome was shown to Che Ahmad bin Hassan, of the Singapore Gardens staff, he called it *Temu Lawas*, but that name properly belongs to *C. xanthorhiza*.

6. **Curcuma mangga** Val. et v. Zijp, Buil. Btzg., 2nd Ser. XXVII: 50, t. 6, f. 1. 1918. Ridl., Flora 4: 254.

Rhizome outside pale dull yellowish, young parts white; inside pale lemon or sulphur yellow, smelling of carrots, taste like a carrotty mango; primary tuber ovoid, c. 6 by 4 cm.; branches in all directions, many, close, more or less cylindric, c. 1·5 cm. thick, again branched especially on lower sides, and then branched a third time; ends of branches white, rather acute; scale-leaves rather persistent. *Leaf-shoot* c. 110 cm. tall, with 5–7 leaves and sheaths below them; sheaths sometimes slightly purple. *Smallest leaf-blade* 16–32 by 7–12 cm., petiole 0·5–2 cm., sheath 23–30 cm. *Largest leaf-blade* 56–60 by 13–15 cm., petiole 12–18 cm., sheath 40–45 cm. Leaf-blade entirely green, base not sharply distinct from winged petiole, apex rather abruptly caudate, cauda 2·5 cm. long. *Ligule* narrow, shortly hairy all along edge; edges of upper part of sheath, which is continuous with ligule, also hairy. *Inflorescence* separate from leaf-shoot; peduncle c. 15 cm. tall; spike to 15 cm. tall; coma-bracts (c. 9) white in basal half, distal half purple, about 5·5 cm. long; intermediate bracts with white and purple stripes; rest green; bracts below coma c. 4 cm. long, adnate for half their length. *Flowers* pure white with yellow midlobe on lip; stamen-filament c. 3 by 3 mm.; anther affixed near its base, pollen-sacs 4–5 mm. long, spurs narrow and parallel, slightly curved.

This species is cultivated in Java and Malaya, and known as *Temu Pauh*, because of its mango-like odour when the rhizome is cut. In Singapore at least it rarely flowers; the above description of flowers is taken from Valeton. Valeton states that *C. mangga* does not occur in the teak forests of Java as do other cultivated Curcuma species. It is used both medicinally and to a less extent in food.

In Java there is a variety (var. *rubrinervia*) which has some purple on the leaves, but this has not been reported in Malaya. Valeton also records another variety (var. *sylvestris*), but this is perhaps a distinct species, nearer to *C. zeodaria* than to *C. mangga*.

7. **Curcuma aeruginosa** Roxb., Asiat. Res. XI: 335. 1810. Fl. Ind. 1: 77. 1820. Roscoe, Monandr. Pl. t. 106. K. Schum., Pflzr. Zingib. 112. Ridley, Flora 4: 254. Valet., Bull. Btzg. 2nd Ser. XXVII: 65, t. 7, f. 2; t. 3, f. 5.

Primary tuber large, conical; rhizomes to c. 16 cm. long and 3 cm. thick, not so crowded as in some species, colour

outside grey and shining, tips pink, inside bluish or blue-green with a white cortex; root-tubers rather large, many, on short roots. *Leaf-shoots* more than 100 cm. tall. *Leaf-blades* with a wide brownish suffusion on each side of the midrib (on both upper and lower surfaces) on the distal half only, groove of midrib green throughout; blades 45 by 16 to 80 by 20 cm.; petioles 0–17 cm. long; sheaths to 50 cm.; outer leaves wider than middle ones. *Inflorescence* separate from the leaf-shoot; scape 20–50 cm. tall, enclosed by 2 or 3 long sheaths; spike 14–18 cm. tall, 6–8 cm. wide. *Coma-bracts* purple, to 7 cm. long, with a very short but distinct tip, lower ones streaked with green; flowering bracts light green, upper ones at least purplish at the tip, adnate for less than half their length, c. 5 cm. long; *bracteoles* c. 17 mm. long. *Corolla-lobes* and tube deep crimson-pink; staminodes and lip pale yellow, median band on lip deep yellow; anther-spurs of medium length.

The type of this species came from Burma. The species is widely cultivated in Malaysia, and always known as *Temu Hitam*, owing to the bluish internal colour of the rhizome, as distinct from the yellow or orange colour of most species. The rhizome is only used medicinally.

8. **Curcuma zeodaria** (Bergius) Rosc., Monandr. Pl. t. 109. 1828. Ridl., Flora 4: 254. K. Schum., Pflzr. Zingib. 110. Valet., Bull. Btzg. 2nd Ser. XXVII: 57, t. 27, t. 7. *Amomum zeodaria* Bergius, Mat. Med. 41. 1788. **Fig. 5.**

Rhizome inside pale sulphur yellow to bright yellow, turning brownish when old, taste very strong and bitter, odour when crushed rather acrid. Main tuber broadly ovoid, to c. 8 by 5 cm.; branches to 2·5 cm. thick, rather short, some turning upwards and forming new leaf-shoots, secondary branches many, short and thick, all curved upwards; roots many, thick and fleshy, descending and bearing tubers. *Leaf-shoots* to c. 100 cm. tall, with c. 5 leaves. *Lowest leaf-blade* to 35 by 13·5 cm., petiole 3 cm., sheath to 40 cm. long. *Upper leaves* longer with petiole to 12 cm. or more; young leaves with purple flush to 15 mm. wide on each side of upper surface of midrib, and a narrower purple band on the lower surface; purple fading in old leaves. *Inflorescence* separate from leaf-shoot; scape 22 cm. tall, with 3 sheathing leaves which cover it, their short tips rounded; spike 16 cm. tall; lowest bracts entirely green, middle ones tipped with a spot of purple, uppermost 5 entirely purple with below them 4 streaked white and pale green at the base, purple at tips; lowest bracts 5 cm. long, 4·6 cm. wide, joined to others for half their length, tip very broadly triangular, blunt. *Flowers* c. 5 to each bract; bracteoles to 13 mm. long. *Calyx* 8 mm. long, slightly pink, teeth short and broad. *Corolla-tube* to constriction 17 mm. long, throat 10 mm. long; lobes 16 by 11 mm., white, faintly pinkish at tips. *Staminodes* 12 by 10 mm., very pale yellow, with concave median fold as seen from the back. *Lip* very pale yellow with bright yellow median band which has short red margins towards its base, width in natural position 15 mm., apex slightly cleft. *Stamen:* filament 4·5 mm. long, and wide; anther in all 6 mm. long, with divergent curved basal spurs 3 mm. long.

This species is considered to be native in north-eastern India. It is apparently wild in Java, but may have been introduced there by man. It is widely used as a medicine in India and Malaysia, and well known in Malaya as *Temu Kuning*. The leaves and young buds are used in India and Java as flavouring but this use is probably not common in Malaya.

9. **Curcuma xanthorhiza** Roxb., Fl. Ind. 1: 25. 1820. Ridl., Flora 4: 254. Valet., Bull. Btzg. 2nd Ser. XXVII: 61, t. 28; t. 8, f. 1.

Primary tuber large, often 10 cm. long; rhizomes few and rather short, thick, with few branches, externally pale orange, internally intense orange or orange-red, young parts paler; root-tubers large, 5–30 cm. long. *Leaf-shoots* often 200 cm. tall, bearing up to 8 leaves. *Leaf-blades* c. 40 by 15 to 90 by 21 cm., with a dark purple feather-shaped stripe 10 mm. wide on each side of the green midrib, not reaching the base; in outermost leaves midrib only purplish, no purple colour beyond it. *Petiole* 0–30 cm. long, its apex passing gradually into the blade; ligule small; sheaths to 75 cm. long, green. *Inflorescence* separate from the leaf-shoot; scape 15–20 cm. long; spike 16–20 cm. long, 8–10 cm. wide. *Coma-bracts* purple, to 9 cm. long, the uppermost much narrower than the others; flowering bracts light green, 5–6 cm. long; bracteoles to 25 mm. long. *Flowers* about as long as bracts. *Corolla-lobes* light red; staminodes whitish; lip yellowish with deeper median band; anther short and broad, the spurs about as long as the pollen-sacs and not much spreading laterally.

This species was described by Roxburgh from a plant said to have been introduced to Calcutta from Amboyna. *C. xanthorhiza* is well known to Malays as *Temu Lawas*. It is the largest species of Curcuma found in Malaya. The smell of the rhizome is pungent and the taste bitter (Burkill). It is used extensively in native medicine in Malaya, and sometimes as food, after rasping and soaking in water to remove the bitterness.

3. HEDYCHIUM Koenig

Terrestrial or epiphytic plants. *Stems* 50 cm. to 2 m. tall (in Malaya), arising from a fleshy rhizome; roots in epiphytic species also fleshy. *Leaves* usually glabrous, short-stalked; *ligule* small or large. *Inflorescence* terminal on leafy stems; *bracts* broad and densely imbricating (quite covering the rachis) *or* narrower, enfolding their flowers, (the rachis then usually visible between them), *flowers* usually 2 or 3 to each bract; *bracteoles* tubular (at least in most Malayan species). *Calyx* tubular, slender, shortly and unequally toothed at the apex, often hairy. *Corolla-tube* slender, usually much longer than the calyx; lobes rather

long and narrow, reflexed in the flower. *Staminodes* petaloid, usually about as long as the corolla-lobes but wider, white or coloured. *Labellum* broader than the staminodes, sometimes much broader, with narrow basal part and elliptic or obovate blade, more or less deeply bilobed. *Filament* long and slender; *anther* 2·5–10 mm. long, the bases of the pollen-sacs free for a short distance, sometimes slightly diverging. *Ovary* trilocular, ovules axile, in 2 rows in each loculus, numerous. *Capsule* trilocular, loculicidal, splitting to the apex. *Seeds* with aril divided deeply into many long irregular lobes.

Schumann included 38 species in Hedychium, as known in 1904, and a few more have since been described. The centre of distribution is the eastern Himalayas; a few species have been described from southern India on the one hand and Malaysia on the other. In Malaya we have six native species (the seventh perhaps escaped from cultivation) ; two of them are very nearly allied and perhaps should be united, and two others are known from single collections only. Only one can be called common and widespread in Malaya, the epiphytic species *H. longicornutum*. *H. coronarium*, stated to be native in Burma, has large white fragrant flowers with a very broad lip and broad staminodes; it is often cultivated in Malaya.

The characteristic features of the genus are the terminal inflorescence with 2–3 flowers to each bract, the long staminodes and stamen and deeply bilobed lip. As noted elsewhere, Hedychium has much in common with Alpinia; if we could reduce the staminodes and shorten the stamen we should have something very near some members of the Alpinia group.

The genus Hedychium has received some attention horticulturally, and contains some very beautiful species. Apart from *H. coronarium* most of these are not very well suited to the lowland climate of Malaya. Several garden hybrids have also been produced; their production appears to be easy, and attempts might well be made to breed garden forms suited to the Malayan lowlands.

KEY TO THE MALAYAN SPECIES OF HEDYCHIUM

Bracts broad and overlapping, quite hiding the rachis, the lowest bracts c. 4 cm. wide

Lip c. 3·5 cm. wide, staminodes 1·2 cm. wide
1. *H. chrysoleucum.*

Lip and staminodes much narrower
2. *H. malayanum.*

Bracts much narrower, all or nearly all folded to enclose their flowers, leaving the rachis visible (except in *H. longicornutum* where they are very densely crowded)

Anther about 3 mm. long; bracts not densely crowded
Bracts glabrous 3. *H. collinum.*
Bracts hairy
Calyx tube 2·5 cm. long, hairy towards base only 4. *H. macrorhizum.*
Calyx tube 4 cm. long, hairy throughout
Leaves to 45 by 12 cm.; ligule hairy 5. *H. hirsutissimum.*
Leaves to 28 by 7·5 cm.; ligule glabrous 6. *H. paludosum.*
Anther 7–10 mm. long; bracts densely crowded; epiphyte 7. *H. longicornutum.*

1. **Hedychium chrysoleucum** Hook., Bot. Mag. t. 4516. 1850. *H. coronarium* var. *chrysoleucum* Bak., F.B. I. 6: 226. 1892.

Plant about 100 cm. tall. *Leaves* to about 40 by 8 cm., with narrow tip c. 3 cm. long and narrowly cuneate base, hardly stalked, hairy on midrib beneath and sparsely so on sheath; *ligule* to 4 cm. long, hairy. *Inflorescence* erect; *peduncle* short; *rachis* and bracts together to 12 cm. long; lower bracts imbricating, about 5 cm. long, very broad, bluntly pointed; hairy towards apex and on the upper edge; upper bracts folded round their flowers. *Ovary* hairy. *Calyx* tube narrow, c. 3·7 cm. long, glabrous except for a few hairs at the top. *Corolla*-tube projecting 4 cm. beyond the end of the calyx tube; *lobes* nearly 4 cm. long, narrow, pale yellow. *Staminodes* and *lip* white, flushed orange-yellow or salmon towards base; *staminodes* as long as petals, 1·2 cm. wide. *Labellum* as long as staminodes, 3·5 cm. wide, bilobed, lobes rounded, the cleft between them 8 mm. deep. *Filament* about as long as lip, orange or salmon; *anther* 1 cm. long, the free basal lobes of the pollen-sacs 3 mm. long.

This species was originally described from plants taken to Europe and there cultivated. Its distribution is uncertain. Plants have been found on Penang Hill and in Kelantan; it is possible that they are escapes from cultivation.

H. chrysoleucum is certainly very closely allied to *H. coronarium*, and has been ranked as a variety of that species; but *H. coronarium* has a lip 5 cm. wide, staminodes 2·2 cm. wide and a shorter filament. The bracts are identical in both, though Schumann says not.

SPECIMENS. *Penang* Hill, 2,500 feet, S.F.N. 2571 (Burkill). *Kelantan.* Kampong Parit, S.F.N. 10232 (Haniff and Nur).

2. **Hedychium malayanum** Ridl., Flora M. Penin. 4: 241. 1924.

Height of stems not recorded. *Leaves* to 35 cm. long, longest leaves 8–11 cm. wide, glabrous, widest 1/4–1/3 from the apex, apex in lowest leaves broadly pointed, in upper leaves shortly tipped, basal 2/3 gradually narrowed, base very narrowly cuneate; *petiole* to about 4 cm. long; *ligule* broad, to 4 cm. long, hairy; *sheath* and midrib of leaf sparsely hairy. *Peduncle* short, stout, curved, short-hairy. *Inflorescence* from base of lowest bract to tip of apical one c. 14 cm. long. *Bracts* very broad, overlapping, glabrous, lowest about 6 cm. long and 4 cm. wide, apex broadly rounded with a very small thickened tip; each bract enclosing 3 or more flowers; *bracteole* broad, hairy, 3 cm. long, tubular at base only. *Flowers* white. *Calyx* tube slender, 6·5 cm. long, widening a little in the distal half, glabrous except for a few hairs on the short teeth, cleft to a depth of 3 mm. *Corolla*-tube slender, 4 cm. longer than the calyx; lobes 4–4·5 cm. long, narrow. *Staminodes* 5–5·5 cm. long, 3 mm. wide, widest near blunt apex. *Labellum* 3·8–4·8 cm. long, basal 1–1·5 cm. narrow, blade of lip obovate, c. 1·6 wide, cleft to a depth of 1·5 cm., inner edges of lobes nearly straight and close together, outer edges curved, tips shortly pointed. *Filament* 5 cm. long beyond tube of flower; *anther* 9 mm. long, the free basal ends of the pollen-sacs 3 mm. long; not diverging. *Stigma* densely hairy, hairs nearly 1 mm. long.

The species has been found several times both at Fraser's Hill and at Cameron Highlands, and is to be expected at other places on the Main Range. There is much variation in the size of the parts of the flower, though the proportion of the parts is naturally constant. The size of labella of different flowers on the same inflorescence may vary. The relative depth of the cleft of the lip varies a little. Ridley states that the calyx is half an inch long, but the calyces he saw were broken.

Specimens. *Pahang.* Fraser's Hill, Mrs. Ferguson-Davie, October 1921 (type); Upper Tras Valley, S.F.N. 7875 (Burkill and Holttum). Cameron Highlands, 4,800 feet, Henderson s.n. 3.4.1930; Batten-Pooll s.n., November 1939; Boh Plantations, 4,000 feet, S.F.N. 32581 (Md. Nur). Telom, Ridley s.n. November 1908.

3. **Hedychium collinum** Ridl., J.S.B.R.A.S. 32: 103. 1899. Flora 4: 241.

Plant to c. 100 cm. tall. *Leaves* to 30 by 6·5 cm., narrowly elliptical, acuminate, glabrous; *stalk* to about 1 cm. long; *ligule* to 2 cm. long, glabrous. *Inflorescence* usually bent at an angle to the leaf-stem; *rachis* to 12 cm. long, glabrous; *peduncle* 2–3 cm., curved. *Bracts* to 3·3 cm. long, broadly pointed, glabrous, embracing the flowers, each with 2 or 3 flowers; *bracteoles* tubular rather sparsely hairy, the hairs straight, to about 2 mm. long. *Calyx* hairy throughout, more densely towards base, 3·5–4 cm. long, teeth blunt, cleft 3–4mm. *Corolla-tube* protruding 2 cm. beyond calyx, slender; *segments* c. 3·5 cm. long, 2 mm. wide near apex, white or very pale greenish. *Staminodes* as long, and 3 mm. wide, colour as petals. *Lip* white, deeply cleft, the halves with one straight and one rounded edge, bluntly pointed, each c. 8–10 mm. wide.

Stamen: filament red, slender, c. 5·5 cm. long. *Anther* 3 mm. long, the short basal lobes slightly diverging. *Stigma* with hairs on edges.

Ridley states that the inflorescence is nodding; but it is more probably erect from a partially decumbent stem, as in some other species.

SPECIMENS. *Kedah.* Kedah Peak, 4,000 feet, Ridley s.n. June 1893 (type); Robinson and Kloss, 6027 (F.M.S. Mus.). *Pahang.* G. Tahan, Ridley 15945; Wray and Robinson 5513; 4,500 feet, S.F.N. 20781 (Holttum).

4. **Hedychium macrorhizum** Ridl., J.S.B.R.A.S. 32: 102. 1899. Flora 4: 242.

Epiphyte: roots stout. *Stems* c. 30 cm. long below inflorescence (Ridley). *Leaves* 20 by 6 to 23 by 5 cm., narrowly elliptic-oblong, apex apparently short-pointed, glabrous, stalk under 1 cm. long, ligule c. 3 mm. long, short-hairy. *Inflorescence* bent at an angle to the leaf-stem; scape short; rachis slender, 20 cm. long, sparsely hairy. *Bracts* 1·5–3 cm. apart, to 2·5 cm. long and 7 cm. wide, hairy at base, apex broadly rounded, hardly pointed, each with 3 flowers; bracteoles much shorter, similarly hairy. *Flowers* white. *Calyx* tube slender, to 2·5 cm. long, hairy in basal part, teeth rather broad, blunt, cleft only 1·5 cm. *Corolla*-tube about 1·5 cm. longer than calyx: corolla-lobes c. 2·2 cm. long, under 2 mm. wide. *Staminodes* little shorter and wider than corolla-lobes. *Lip* deeply bifid, c. 2 cm. long, lobes narrowed to tips, each 3 mm. wide at base. *Stamen* filament 3·5 cm. long. *Anther* 3 mm. long.

SPECIMENS. 15th mile Pahang Track, Selangor, Ridl., July 1897, 8477 (Type).

Ridley states that the inflorescence is deflexed; but it seems more likely that the inflorescence is erect; the stem being horizontal or obliquely ascending (as it often is in the common epiphytic species *H. longicornutum*), the inflorescence bends at an angle to the stem to assume an upright position.

5. **Hedychium hirsutissimum** Holtt., **sp. nov.**

Lamina folii ad 45 cm. longa et 12 cm. lata, elliptica, apice breviter acuta, basi late cuneata (?); *ligula* dense hirsuta; vagina sparse hirsuta. *Pedunculus* curvatus, appresso-hirsutus, 2 cm. longus; *rachis* inflorescentiae c. 10 cm. longa, hirsuta; *bracteae primariae* 5–10 mm. dissitae, ad 2·5 cm. longae et 8 mm. latae, obtusae, dorso hirsutissimae, flores 3 foventes. *Bracteolae* ad 2 cm. longae, hirsutissimae; *calyx* 4 cm. longus, capillis 1·5 mm. longis brunneis satis rigidis vestitus, ad 3 mm. fissus, lobi parvi, conferti; *corollae* tubus quam calycem 10 mm. longior, lobi c. 2·5 cm. longi, 2·5 mm. lati, acuti; *staminodia* 2 cm. longa, obtusa; *labellum* angustum, staminodiis aequilongum, bilobatum; *filamentum* lobos corollae haud superans (?); *anthera* 3 mm. longa, thecis basi liberis, obtusis, haud divergentibus.

TYPUS: Perak, Taiping Hill, 4,300 feet, leg. Berwick, no. 215, 12.12.1939.

This species is nearly allied to *H. paludosum*, but has longer leaves and a hairy ligule. Unfortunately only a single leaf and inflorescence are available, so that the habit of the plant is unknown. It may possibly be an epiphyte. The very large leaf and very hairy inflorescence are striking characters. When better material is available it is probable that more distinctions from *H. paludosum* will be found. It is remarkable that this species was found on Taiping Hills, an area which has been visited by many botanists in the last 60 years and of which the flora is better known than that of most parts of Malaya.

6. **Hedychium paludosum** Hend., Journ. M.B.R.A.S. 5: 273. 1927.

Terrestrial, in sphagnum bogs. Height of stems c. 120–150 cm. *Leaves:* blade glabrous, to 28 by 7·5 cm., narrowly elliptic, apical 2–3 cm. very narrow, petiole under 1 cm. long, ligule 2–3 cm. long, glabrous. *Inflorescence* erect, to about 18 cm. long; peduncle 2–10 cm., rachis more or less clothed with appressed straight hairs 2–3 mm. long. *Bracts* to 2·5 cm. long, hairy on back, broadly pointed, enclosing 2 or 3 flowers, upper bracts somewhat smaller than lower. *Bracteoles* hairy, tubular. *Calyx* tube 4 cm. long, densely hairy, slender, cleft about 3 cm. on one side only. *Corolla-tube* slender, protruding about 2·5 cm. beyond calyx; lobes 3 cm. long, widest near acute apex, 2 mm. wide, white. *Staminodes* as long as petals, thinner and a little wider, more narrowly pointed. *Lip* white, as long as staminodes, deeply cleft, the halves pointed, each about 7 mm. wide. *Stamen:* filament red, slender, 6 cm. long: anther hardly 3 mm. long, the pollen-sacs diverging a little at the base, bluntly rounded, the free parts little over ½ mm. long. *Stigma* small cup-shaped, edges short-hairy. *Fruits* said to be deep orange: not seen.

Specimens. *Pahang.* Cameron Highlands, 4,800 feet, S.F.N. 17844 leg. Henderson (Type); Batten-Pooll s.n. November 1939; F.D. 20834 (Symington); 4,800 feet, S.F.N. 23280 (Henderson).

This species occurs at Cameron Highlands in Sphagnum bogs in open places, associated with *Dilochia Cantleyi*, *Nepenthes sanguinea* and other interesting plants. Where it occurs, it is abundant, and flowers freely. It is very nearly related to *H. collinum* Ridl. but seems to be larger and has the bracts and rachis of the inflorescence hairy. It may perhaps be specially adapted to the sphagnum-bog habitat while *H. collinum* grows under different conditions.

7. **Hedychium longicornutum** Bak., F.B. I. 6: 228. 1892. Ridl., J.S.B.R.A.S. 32: 100. 1899. Flora 4: 242. *H. crassifolium* Bak., F.B. I. 6: 228. 1892. **Fig. 6, 7.**

Epiphyte with fleshy roots. *Stems* to about 60 cm. long. *Leaves:* texture very firm, to about 32 cm. long; width of leaves 30 cm. long varies from 5 to 8 cm., narrowed gradually to base, usually widest 1/3 from apex, apex shortly narrow-acuminate, edges hairy on the lower surface, especially towards

apex, and midrib below sparsely hairy; ligule 2–6 cm. long, longest on upper leaves. *Inflorescence* erect (peduncle usually curved), peduncle and rachis together to c. 10 cm., bracts and flowers densely packed: size of inflorescence varies much with size of shoot bearing it; base of inflorescence covered with imbricating hairy sheaths. *Bracts* rather densely brown-hairy, 2·5–3 cm. long, 5 mm. or more wide. *Bracteoles* c. 1·7 cm. long, finely hairy, tubular. *Calyx* tubular, slender, with ovary 4 cm. long, hairy, pale salmon, with 3 short points close together, cleft on opposite side 5 mm. *Corolla-tube* little longer than calyx, lobes in bud bright red, when expanded duller, the edges much inrolled, 4–6 cm. long, c. 5 mm. wide when flattened. *Staminodes* curled backwards, slightly fleshy with shining surface, light orange-scarlet, yellow towards base, about 3·2 cm. long and 5 mm. wide. *Lip* 2·4 cm. long, divided almost to the base, the two halves curled backwards, long-pointed, each about 2·5 mm. wide near the base, colour as staminodes. *Stamen:* filament 5–7 cm. long beyond corolla-tube, apex cream, base pale salmon, anther slightly curved, 1–1·2 cm. long, yellow to orange, free basal lobes 2 mm. long, not diverging. *Stylodes* 2 mm. long, fleshy, blunt, not surrounding the style, pale yellow. *Ovary* 5 mm. long, densely hairy. *Fruit* strongly angled, slightly hairy, 2–2·5 cm. long, orange; seeds 10–12 in each loculus, ellipsoid, 4–5 mm. long, with red aril divided into many narrow flat ribbons longer than the seed, their ends intertwined; dehisced fruit bright orange within.

There are many collections of this species, from all parts of Malaya except Singapore. The plants grow in low country or at moderate altitudes, as epiphytes in forest, in shady places, often not far above the ground. The width of leaves varies much on different shoots of the same plant, but is fairly uniform on each shoot; the lowest leaves are always shortest. Narrow leaves are about equally narrowed to base and apex, wider leaves widest near apex, on the same plant.

The species *H. crassifolium* Bak. is described as differing from *H. longicornutum* as follows: leaves narrower (they are very variable), flowers bright yellow (the colour varies), bracts glabrous, corolla-lobes and lip a little longer. The differences are thus hardly definable, and the two species are most probably identical. They were described simultaneously, and were first united by Ridley, who chose the name *H. longicornutum*.

4. CAMPTANDRA Ridley

Leafy stems usually close together, slender, each bearing 2–6 leaves on the upper half, the lower part covered by bladeless sheaths. *Leaf blade* elliptic, asymmetric, acute, petiole short to fairly long. *Inflorescence* terminal on the leafy stem, consisting of a single cincinnus in the axil of a large concave bract, the axis of the inflorescence continued

for a short distance only beyond the bract; rarely the axis is continued further and bears a second bract. *Bracteoles* thin, broad, with inflexed sides, each in turn completely enclosing the remaining parts of the cincinnus, the sides quite free, not tubular. *Ovary* 3-locular, with many ovules. *Calyx* short, narrowly funnel-shaped, the lobes short and broad. *Corolla-tube* slender, somewhat longer than the bract; lobes broad, subequal, the apical one concave with a short point at the tip. *Staminodes* nearly circular, spreading, white or lilac-mauve. *Lip* broad, spreading, 2-lobed, the lobes round, coloured like the staminodes, with or without yellow or crimson marks near the base; base slightly grooved, leading to the tube of the flower. *Filament* very short and broad; *anther* with parallel pollen-sacs which are separately prolonged at the base into parallel blunt sterile appendages set at an obtuse angle to the fertile part and nearly as long; apex of connective not prolonged into a crest. *Stigma* spherical, much wider than the style, with a narrow elliptic mouth. *Stylodes* absent. *Fruit* ellipsoid, thin-walled, containing many seeds, covered with translucent arils.

Camptandra is a small genus, only known to occur in Malaya and Borneo; it may be expected also in Sumatra. It is closely allied to Stahlianthus of Indo-China, and the two might perhaps be united; but the published details concerning the inflorescence of Stahlianthus are not adequate to decide the question.

The inflorescence of Camptandra has always been called terminal, and so in a sense it is; but the flowers are all part of a cincinnus in the axil of a bract, and so are on a lateral branch-system. The terminal part of the inflorescence is a short slender tip extending just above the insertion of the bract, and has not been mentioned by any author; it sometimes extends and bears another bract containing a cincinnus of flowers. The structure of the inflorescence is like that of *Scaphochlamys malaccana* if cut off just above the first bract. The habit of the plant, with slender stem bearing a few leaves in its apical part, is very unlike any Scaphochlamys, though quite like *Boesenbergia pulcherrima*. The structure of the flowers is very like Kaempferia, except for the basal sterile extensions of the pollen-sacs and the lack of anther-crest. The complete absence of stylodes occurs also in *Kaempferia cuneata* Gagnep. (from description, not seen). The base of the anther is very much like that found in Roscoea. The genus is in fact one of the Kaempferia group but distinct in its habit, its peculiar inflorescence combined with the anther-structure. The seeds also are very numerous, and Ridley reports that fruits

are freely produced. In contrast to Scaphochlamys, the species are not highly localized; *C. parvula* is one of the most widespread forest plants in Malaya, and often abundant.

KEY TO THE MALAYAN SPECIES OF CAMPTANDRA

Leaves about 6–8 by 2·5–3·5 cm., base narrowly rounded to cuneate ..... 1. *C. parvula.*

Leaves larger, base cordate or subcordate

Stems 30–50 cm. long to top of bract, with 4–6 leaves ..... 2. *C. latifolia.*

Stems 10–20 cm. long to top of bract, with 2 (rarely 3) leaves ..... 3. *C. ovata.*

1. **Camptandra parvula** (King ex Bak.) Ridl., J.S.B.R.A.S. 32: 104. 1899. Flora 4: 243. *Kaempferia parvula* King ex Bak., F.B. I. 6: 223. 1890.

Stems growing in a tuft, close together, slender, about 10–20 cm. long from base to top of inflorescence, bearing 3–5 leaves. *Leaves* usually 6–8 cm. (exceptionally to 10 cm.) long and 2·5–3·5 cm. wide, asymmetric with a curved midrib, elliptic, apex shortly acuminate, base rather narrowly rounded to cuneate; petiole usually 5–10 mm. long, exceptionally to 2 cm.; sheath to about 2 cm. long; ligule-lobes narrowly triangular, about 5 mm. long; lower surface of leaf and petiole, also ligule and sheath short-hairy; young leaves pinkish, sheaths and petioles sometimes red. *Peduncle* shorter than the uppermost leaf-sheath. *Bract* 1, or rarely 2, fleshy, when flattened ovate, the sides infolded towards the base, spreading near the acute apex; length about 3–3·8 cm., width 2·4–3 cm. when flattened, slightly hairy near apex only; base adnate to the axis for a height of about 5 mm., the slender axis-tip extending about 4 mm. beyond this. *About 4 flowers* in each bract. *First bracteole* about 8 mm. long, nearly 1 cm. wide at base; second about 6 mm. long. *Ovary* at flowering about 4 mm. long. *Calyx* (without ovary) 6 mm. long; narrowly funnel-shaped, lobes unequal, short, truncate, fringed with a few hairs. *Corolla-tube* 1·3 cm. long, widening slightly towards the opening; lobes white, about 8 mm. long and 7 mm. wide, the dorsal one concave with a short tip, all oblong with broad apex. *Staminodes* about 1·2 cm. long and 1·0 cm. wide, spreading, nearly circular, white. *Labellum* about 1·4 cm. long and 1·5 cm. wide, 2-lobed about half-way to the base, the lobes rounded and overlapping, grooved towards the base, white with an orange-yellow spot in the middle at the base, with a pink to crimson band and short rays on either side of it. *Anther* 4 mm. long from attachment to apex of pollen-sacs; basal appendages 3 mm. long.

The species is found in lowland forest and to medium elevations on the mountains in almost all parts of Malaya (not Singapore Island), being often quite abundant. It appears sometimes to occur as high as 3,000 feet; above this the other species are found. Of his collection at Ulu

Bendong, Kemaman (700 feet alt.) Corner notes "common in the forest, on stream sides and on rocks in streams and waterfalls."

Corner's S.F.N. 30874 from Ulu Segun (G. Panti) had the stem and petioles red, the leaves only slightly hairy beneath, and pink markings on the lip. It is more slender in habit than some other collections. Whether it is a distinct variety is unknown, as such colour-notes are lacking in the case of other specimens. Of this collection Corner states "growing on the big rocks in the river and riverside, in flood zone, common."

2. **Camptandra latifolia** Ridl., J.S.B.R.A.S. 32: 105. 1899. Flora 4: 243. **Fig. 8.**

Stems 30–50 cm. tall, bearing 4–6 leaves. *Leaf-blade* 10 by 4 to 20 by 8 cm. (exceptionally to 10 cm. wide), slightly asymmetric, ovate to elliptic with rather abruptly caudate apex (the cauda to 2·5 cm. long, narrow), base slightly cordate, main veins numerous, close, usually glabrous except for the base of the midrib beneath and the upper part of the petiole; *petiole* and sheaths usually purplish; *petiole* 2–3 cm. long; ligule lobes short, broad and rounded, 2–3 mm. long. *Peduncle* shorter than uppermost sheath. *Bract* solitary, about 3–3·5 cm. long, to about 5 cm. wide (when flattened), green. *Calyx* about 8 mm. long. *Corolla-tube* 2·5–3·5 cm. long; lobes 1·5–2·0 cm. long, white. *Staminodes* to about 2·5 cm. long, white or violet. *Lip* 2·5–3 cm. long, wider than long, white or violet, the ridges at the base yellow.

This is the largest species of the genus. It has been found only on the Main Range in Perak and just over the border on the Pahang side at 3,000–5,000 feet elevation. It is very common at Cameron Highlands where it seems always to have white flowers. It has not been found on Taiping Hills nor G. Tahan.

SPECIMENS. *Perak.* Bûjong Malacca, Ridley 9523, Curtis 3315 (flowers violet). Kinta, 3,500–4,000 feet, King's Collector 7219 (flowers violet). G. Batu Puteh, 4,500 feet, Wray 207. *Pahang.* Cameron Highlands: G. Berumban, Ridley s.n. November 1908; near Tanah Rata, 4,800 feet, S.F.N. 17727, flowers white (Henderson); 5,000 feet, S.F.N. 20983 (Symington); 5,000 feet, Henderson 11180 (F.M.S. Mus.); path to Telom, 5,000 feet, Holttum s.n. 10.4.1930; Batten-Pooll s.n. November 1939—January 1940; Rhododendron Hill, 5,000 feet, Henderson 11061 (F.M.S. Mus.).

3. **Camptandra ovata** Ridl., Mat. Fl. M.P. 2: 12. 1907. Flora 4: 244. *Camptandra tahanensis* Ridl., Journ. F.M.S. Mus. 6: 184. 1915.

Stems usually 10–20 cm. long from base to the apex of the floral bract, with 2 or rarely 3 leaves; bladeless sheaths dull red. *Leaf-blade* variable, to about 12 cm. long and 4·5 to about 10 cm. wide, shaped as in *C. latifolia* but the apex less narrowly caudate and usually with fewer main veins, the lower surface quite glabrous; petiole 1·5–4 cm. long; ligule short and rounded as in *C. latifolia;* sheath glabrous, flushed with

dull red. *Peduncle* as long as or a little longer than the uppermost leaf-sheath (to 1·5 cm. longer). *Bract* 2–3 cm. long, wider than long. *Flowers* usually white (sometimes pale violet?); corolla-lobes about 1·1 cm. long and rest of flower in proportion.

This species has been found on G. Tahan, and on the Main Range at and near Fraser's Hill. Ridley described a specimen from G. Tahan as a new species, but I see no clear distinction between his type of *C. tahanensis* and that of *C. ovata*. He said the corolla-tube in *C. tahanensis* was much longer than the bract, but this is not shown by the specimen; and in any case the length of the corolla-tube is probably variable. *C. ovata* differs constantly from *C. latifolia* in having much shorter stems with two (or rarely 3) leaves, leaves usually rather smaller and glabrous beneath, bract rather smaller and flowers smaller; also in the peduncle being usually a little longer than the uppermost leaf-sheath. There are in the Singapore Herbarium two specimens from Fraser's Hill which are rather different and may perhaps represent an undescribed species, but the flowers are not well preserved. Their stems are stouter than usual in *C. ovata*, the leaves to 11 by 6·2 cm., more narrowly caudate than usual, the petioles are only 5–8 mm. long and the sheaths very broad, the bracts to 3·5 cm. long, and the peduncle much shorter than the uppermost leaf-sheath. There are however other specimens intermediate in some of these characters.

SPECIMENS. *Selangor*. Semangkok Pass, 4,000 feet, Burn-Murdoch s.n. February 1904 (Type). Ulu Semangkok, Ridley s.n. August 1904. G. Semangkok, Ridley 15573. G. Mengkuang Lebah, Robinson s.n. 22.1.1913. *Pahang*. Fraser's Hill, S.F.N. 10542 (Md. Nur). Fraser's Hill, Corner s.n. 17.8.1937. G. Tahan: Ridley 15944 (type of *C. tahanensis*); 5,000 feet, S.F.N. 20942 (Holttum); 5,500-7,000 feet, S.F.N. 7951 (Haniff and Nur). DOUBTFUL SPECIMENS. Fraser's Hill: S.F.N. 8639 (Burkill and Holttum); Henderson 11235 (Herb. F.M.S. Mus.).

5. SCAPHOCHLAMYS BAKER

Rhizome creeping, or ascending obliquely and supported on stilt-roots, or almost erect, of long or short elements, each bearing bladeless sheaths and one or more leaves and ending in an inflorescence, the next rhizome-element arising as an axillary bud. Roots relatively slender, not bearing tubers. *Leaf-blade* almost always a little asymmetric, usually elliptic, sometimes purple beneath but more usually green, often slightly hairy beneath, especially on the midrib but never densely so; *petiole* long or short; *ligule* consisting of two lobes, usually triangular, small to large, with a very narrow connecting ridge across the base of the petiole; *sheath* short or long, usually

with broad thin edges connected with the ligule. *Scape* very short or up to nearly 20 cm. long. *Inflorescence* compact and ovoid or ellipsoid, or lax, with the bracts spirally arranged, sometimes spreading and showing the rachis, the lowest ones maturing and flowering first. *Bracts* usually 2–5 cm. long, firm to thin, hairy or nearly glabrous, green or flushed with purple, not joined together laterally. *Flowers* 1–7 in the axil of each bract, each with a bracteole. *Outer bracteole* facing the bract and nearly always considerably shorter, not tubular at the base, but its edges infolded to enclose all the flower-buds and their bracteoles, usually with two conspicuous slightly keeled nerves, sometimes 3-lobed at the apex; either one or two flowers in the axil of this bracteole. *Inner bracteoles* usually much shorter, sometimes nearly as long as the first, 2-ranked, each with a flower in its axil, the flowers (where many) in 2 alternate rows both towards one side of the axis. *Ovary* often unilocular with a small basal group of ovules (sometimes reduced to one) or trilocular; where unilocular, the rudiments of septa often present as longitudinal ridges inside the ovary. *Calyx* usually shorter than the first bracteole, the teeth near together and short, split about ¼ or more down the other side. *Corolla-tube* about as long as bract, or longer, the basal part slender, the apical part widening to a narrow funnel; lobes relatively narrow, the dorsal one somewhat wider than the others, all spreading obliquely, nearly always white. *Staminodes* oblong, usually about as long and wide as the dorsal corolla-lobe but with rounded not acute apex, spreading obliquely. *Labellum* never saccate, the sides little inflexed, usually obovate and more or less deeply bilobed with rounded overlapping lobes, white with a median yellow band, the band often bordered with a purple or violet line and sometimes with crimson marks near the base, slightly grooved in the middle towards the base, this groove ± hairy. *Filament* broad, not longer than the anther and usually a little shorter. *Anther* bent forward so as to be parallel and near to the base of the lip, the pollen-sacs with free acute basal tips (not diverging), the connective prolonged at the apex into a (usually 3-lobed) reflexed crest which is usually but not always wider than the rest of the anther and conspicuous in the throat of the flower. *Stigma* shorter than the anther-crest, small, wider than the style, with transverse elliptic mouth. *Stylodes* two, free to the base, very slender and tapering to the apex. *Fruit* ellipsoid, thin-walled, enclosed by the persistent bracts, at least sometimes unilocular. *Seeds* 1–3, ellipsoid, black, with a white aril lacerate to the base. *Type species*: Scaphochlamys malaccana Bak., F.B. I. 6: 252. 1892.

The main distinguishing feature of this genus is the inflorescence. The bracts are spirally arranged (sometimes on a steep spiral), not laterally joined, each with a cincinnus of several flowers in its axil. This cincinnus is entirely enclosed by a more or less two-keeled bract which almost symmetrically faces the primary bract, its edges free to the base. The cincinnus is of normal structure, but the axes are hardly elongated, so that the whole is very condensed and its structure not very easy to distinguish. The secondary bracts of the cincinnus are usually all much smaller than the first 2-keeled one, but in a few cases nearly as long. They are quite open to the base, never tubular. The whole inflorescence develops in the normal way from base to apex, not the reverse as in Boesenbergia.

This inflorescence is distinguished from Curcuma by the primary bracts being entirely free from each other (not joined to form pouches as in Curcuma) and by the presence of the 2-keeled bract facing the primary bract. Apart from this there are differences in flower-structure discussed by Valeton. The board faux with a hairy ring is not present in Scaphochlamys and the parts of the flower always spread widely. The two genera agree in having the bases of the pollen-sacs free, but in Scaphochlamys the basal sterile spurs of most Curcumas are absent.

Relationships with Kaempferia are discussed under that genus. The two genera are very closely allied, and a good case for their union can be argued, but I consider it preferable at present to maintain them separate. The distinction that in Scaphochlamys there are several flowers to a primary bract and in Kaempferia only one breaks down at *Scaphochlamys biloba* which has only one flower. *Scaphochlamys biloba* also shows an interesting relationship with Zingiber; the structure and relative positions of bract and bracteole (i.e. the 2-keeled bract which alone remains of the secondary bracts) are exactly as in an inflorescence of Zingiber, and indicate the relationship of Zingiber to this group of genera, not to Amomum with which it was placed by Schumann. Another character in common between *S. biloba* (and other species of Scaphochlamys and Boesenbergia) and Zingiber is the presence (in dried specimens) of very dark violet linear spots in the tissue of the thin translucent edges of the bracts and sometimes in calyx and corolla also.

Vegetatively, Scaphochlamys is fairly uniform. The rhizome is never so fleshy as in Kaempferia or some species of Boesenbergia, nor (so far as known) does it have root-tubers as in many species of Kaempferia, Boesenbergia and Curcuma. The branches of the sympodium are either

short or fairly long; their length, their position (whether creeping or obliquely ascending) and the number of leaves on each are characteristic. The inflorescence is always terminal, and there is no distinction between vegetative and fertile shoots (some shoots may fail to produce an inflorescence, as in such a genus as Alpinia, but they are otherwise identical with those which do). It is quite incorrect to speak of the inflorescence as lateral, as Ridley has done. When there is only one foliage leaf on each branch, there are also bladeless sheaths, and the young inflorescence is protected by the longest sheath, imbricating with the sheath of the foliage leaf.

Owing to lack of information about inflorescence-characters, it is impossible to say how widely the genus Scaphochlamys, as here limited, is distributed. It is certainly distributed throughout Western Malaysia and probably into Burma. In Malaya it is one of the most polymorphic groups of the family Zingiberaceae, and has more local species than any other. I have been obliged to describe eight new species, and certainly still more exist. It seems likely that every district of Malaya has its peculiar group of species. More field study is needed to test their uniformity of character and to find the limits of their distribution. One would suspect hybridization, except that the plants in one neighbourhood appear to be very uniform.

The genus Scaphochlamys was established by Baker, who described only the one species *S. malaccana*. He did not see the staminodes, and placed the genus near Elettaria. He did not regard the structure of the inflorescence as important, and placed in Kaempferia the only other Malayan species which he described (*S. concinna*), just as he placed one Malayan Boesenbergia in Gastrochilus and another in Kaempferia.

Ridley transferred *S. malaccana* to Gastrochilus (as *Gastrochilus scaphochlamys*), and included in Gastrochilus also most of the other Malayan species of Scaphochlamys, (though he got them thoroughly mixed up among species of Boesenbergia), but for no apparant reason excluded three of them as Hitcheniopsis. Ridley had no understanding of the vegetative structure of the plants nor of the inflorescence. His work is too full of errors and confusions to warrant discussion. Schumann's conception of the genera Gastrochilus and Kaempferia was also confused, as shown by Valeton, partly owing to inaccurate information in Ridley's published descriptions. Schumann has species of both Boesenbergia and Scaphochlamys in his genus Kaempferia and also in his genus Gastrochilus, and some Scaphochlamys also in Curcuma.

Valeton was the first person to show clearly the difference between the group of *Gastrochilus pulcherrimus* Wall. (now *Boesenbergia pulcherrima*) and that of *Scaphochlamys malaccana*, as regards the inflorescence. He still however included all in the genus Gastrochilus Wall. (= Boesenbergia O. Ktze). As far as flower-structure is concerned, Scaphochlamys is somewhat intermediate between Boesenbergia and Kaempferia, perhaps inclining more to the latter, though its species never (so far as known) show the very broad staminodes resembling the halves of the lip, giving an almost flat quadrate flower, as seen in typical Kaempferia. But in inflorescence-characters Boesenbergia and Scaphochlamys are so distinct that, if they were merged, the only rational procedure would be to include Kaempferia also. Accepting inflorescence-structure as the basic criterion for generic distinction, Boesenbergia and Scaphochlamys are as distinct as any genera in the family Zingiberaceae.

Loesener, in the second edition of the Pflanzenfamilien, is little in advance of Schumann. He quotes Valeton's proposal to sub-divide the genus Gastrochilus (in the broad sense) on inflorescence-characters, but, having inadequate information is unable to apply the scheme to a number of species, and so retains Schumann's unsatisfactory divisions. He adopts the name Boesenbergia instead of Gastrochilus, but includes in it uncritically a great variety of species.

The structure of the partial inflorescences of Scaphochlamys (i.e. the groups of flowers which are enclosed by each bract) was not quite accurately described by Valeton. For his *Gastrochilus laxiflorum* (very closely allied to *S. malaccana*) he stated that "each flower is semi-involute by a small bract (12 mm. long) and accompanied by two very small bracteoles." I have dissected many inflorescences of different species of Scaphochlamys and have never seen these two bracteoles; I suspect the statement is due to an error of observation. Valeton also (following Ridley) speaks of the inflorescence as lateral, from the rhizome; but it is always terminal on a branch of the sympodium, as above stated.

KEY TO THE MALAYAN SPECIES OF SCAPHOCHLAMYS

Each new branch of the sympodium bearing one leaf only
  Bracts about 5 cm. long 1. *Scaphochlamys* sp.
  Bracts to about 3·5 cm. long
    One flower in the axil of each bract; bracteole longer than bract

Upper surface of leaf with broad irregular pale longitudinal band in each half
2. *S. biloba.*
Upper surface without such band
3. *S. longifolia.*
More than one flower in the axil of each bract; bracteoles shorter than bract
Leaves purple beneath
Scape about 15 cm. long
4. *S. sylvestris.*
Scape much shorter
Corolla-lobes 1·5 cm. long; bracts 2·7–3·5 cm. long
5. *S. oculata* (see also *S. concinna*).
Corolla-lobes 8 mm. long; bracts 1·3 cm. long 6. *S. pennipicta.*
Leaves not purple beneath
Inflorescence lax, of 4–7 well-spaced bracts 7. *S. atroviridis.*
Inflorescence compact, of many bracts which are closely imbricating and hide the rachis entirely
Lip with two crimson patches at the base; anther-crest small
8. *S. concinna.*
Lip with violet lines on either side of the yellow band and rather large violet anther-crest
9. *S. breviscapa.*
At least some branches of the sympodium, and usually all, bearing more than one leaf
Bracts about 3 cm. long, as wide as long, or wider
10. *S. Kunstleri.*
Bracts much longer than wide
Scape 7–18 cm. long, much longer than the compact inflorescence 11. *S. perakensis.*
Scape usually less than 7 cm. long, always shorter than the inflorescence
Inflorescence 15–23 cm. long; bracts 1·5–2 cm. apart, narrow, closely appressed to rachis
12. *S. tenuis.*
Inflorescence shorter, bracts arranged otherwise
Leaf-blade to 12 by 3·5 cm., with white bars; inflorescence short, with about 5 spreading bracts 13. *S. lanceolata.*

Leaf-blade of largest leaves much larger, without white bars; inflorescence usually with more than 5 bracts

Inflorescence compact, the bracts imbricating so as to hide the rachis completely

Bracts glabrous except at tip; rhizome erect, bearing 8–10 or more leaves on a single branch 14. *S. erecta.*

Bracts hairy almost all over, at least when young; shoots not erect, with fewer leaves

Edges of bracts conspicuously crisped 15. *S. Klossii.*

Edges of bracts not or very slightly crisped

Leaves to 50 cm. long 16. *S. grandis.*

Leaves to 20 cm. long 17. *S. Burkillii.*

Inflorescence lax, showing the rachis between the bracts

Bracts with crisped edges

Bracts almost glabrous, edges spreading near apex; rhizome erect, bearing 8–10 or more leaves on a single branch 14. *S. erecta.*

Bracts hairy almost all over at least when young, edges incurved to apex; rhizome creeping or ascending obliquely, branches with fewer leaves 15. *S. Klossii.*

Edges of bracts not crisped

Corolla-lobes 8 mm. long; lip with 2 red spots at base 18. *S. rubromaculata*

Corolla-lobes longer; lip without red spots

Ends of bracts broad and flattened, giving a spathulate appearance

19. *S. malaccana.*

Ends of bracts with edges inflexed to the apex, apex acute

20. *S. sub-biloba.*

1. **Scaphochlamys sp.**

Rhizome c. 6 mm. thick when dry; intervals between leaf-shoots 6 cm. or longer. *Leaf-shoots* 1-leaved, with a few broad thin bladeless sheaths, the longest c. 8 cm. long. *Leaf-blade* c. 28 by 15 cm., slightly asymmetric, elliptic, apex broad and hardly pointed, base broadly cuneate, lower surface sparsely hairy throughout, rather densely so on the midrib; *petiole* with sheath c. 25 cm. long; *sheath* apparently very short (not seen). *Scape* c. 3 cm. long, hairy. *Inflorescence* apparently rather obovoid in outline owing to the spreading of the ends of the bracts, c. 6 cm. long and 5 cm. wide. *Bracts* about 5 by 1·6 cm., the basal half or more nearly oblong, the apical 1/3 tapering to an acute point which is curved slightly outwards, almost glabrous except for a few hairs at the apex, thin, with thinner not crisped edges; about 3 flowers in each bract-axil. *Bracteoles:* 1st about 2·7 cm. long, 3-lobed; 2nd about 2·7 cm. long; 3rd about 2·5 cm. long; all very thin. *Calyx* with ovary c. 1·8 cm. long (?).

In its broad long-stalked leaves, short scape, long bracts, and bracteoles all rather long and nearly the same length, this species is near *S. oculata* (Ridl.), and is probably allied. It has however much larger bracts, leaves with very broad blunt apex and hairy beneath, and the flowers are perhaps larger. I think it must be a quite distinct species, but in the absence of flowers do not name it at present.

SPECIMEN. *Pahang.* Karak Forest Reserve, Bentong, S.F.N. 13882 (Best).

2. **Scaphochlamys biloba** (Ridl.) Holtt., **comb. nov.** *Gastrochilus bilobus* Ridl., Trans. Linn. Soc. 3: 379. 1893. J.S.B.R.A.S. 32: 116. 1892. Flora 4: 251. *G. calophylla,* Ridl., J.S.B.R.A.S. 32: 115. 1899.

Rhizome long-creeping, slender, 3 mm. thick when dry; leaf-shoots about 5–14 cm. apart. *Leaf-shoots* each bearing one bladed leaf and several bladeless sheaths; longest sheath to 9 cm. long. *Leaf-blade* 21 by 6–8 cm. in type (in other specimens to 10·5 cm. wide and sometimes both shorter and wider than in the type), dark green above with a diffuse rather broad pale band on each side of the midrib about half-way towards the edge, purplish beneath and hairy on the midrib,

apex bluntly pointed, base rounded to broadly cuneate and somewhat decurrent; petiole purplish (always?), 13 cm. long in type (in other specimens down to 3 cm.), more or less hairy; sheath 2–3 cm. long. *Scape* of inflorescence 1–5 cm. long, slender, slightly hairy. *Inflorescence* of many closely imbricating bracts, ovoid-ellipsoid, to about 4 cm. long and 2–2·5 cm. wide. *Bracts* reddish, about 2 cm. long and 5 mm. wide, elliptic, thin, glabrous, each with one flower. *Bracteole* a little longer than bract, to about 2·3 cm. long, with inflexed edges. *Calyx* with ovary about 1·8 cm. long. *Corolla-tube* about 3 cm. long, widening towards the apex; dorsal lobe 2 cm. long, laterals somewhat shorter, white (or pale cream?). *Staminodes* white, about 1·5 cm. long and 5 mm. wide, oblong, blunt. *Labellum* 2·5 cm. long, about 1·8 cm. wide, obovate, bilobed to a depth of about 7 mm., the lobes rounded, white with a central yellow patch and finely mottled with crimson or pink near the base. *Filament* about 3 mm. long, broad, flushed or spotted with red on the back; anther bent forwards, about 6 mm. long, white or faintly pinkish; crest reflexed and erect in the mouth of the flower, not much wider than anther, almost circular, white.

This species was described by Ridley from a dried specimen collected near the Tahan river, and from a cultivated plant which he brought to Singapore. There is a good coloured drawing of the latter. The wild plant had a long-creeping rhizome, but the drawing (presumably of a plant in a pot) does not show this. The drawing shows short-petioled leaves, whereas the dried specimen has a long petiole. There are dried specimens from S. Keteh with short-petioled leaves exactly as those of the drawing and others with long petioles; it seems certain therefore that the length of petiole can vary considerably with change of environment. There are also colour notes on S.F.N. 8048 and 19663 which agree with the coloured drawing mentioned above.

The inflorescence of the type is in a poor condition. The information that the bracts each have one flower is obtained from S.F.N. 8048. obtained near the type locality. Ridley says there are two bracteoles, but there is only one to each bract in 8048. With the reduction to a single bracteole, the arrangement of flowers is as in Zingiber, and the appearance of the bracteole, thin with inflexed edges and linear dark purplish spots when dry, is just as in Zingiber.

Specimens. *Pahang.* Kuala Tenok, Ridley s.n., 26.7.1891 (Type). Teku River, G. Tahan, S.F.N. 8048 (Haniff and Nur). *Kelantan.* Ulu Sungei Ketih (Ketil), S.F.N. 12098 (Md. Nur). Sungei Ketil, S.F.N. 19663 (Henderson).

var. lanceolata Ridl. *Gastrochilus bilobus* var. *lanceolata* Ridl., J.S.B.R.A.S. 57: 102. 1910. *Gastrochilus minor* quoad Ridl., Flora 4: 252, not of Baker.

Differs from the typical form of the species: 1. rhizome elements shorter (always?), commonly 2–3 cm. long; 2. leaf-blade 12 by 2·7 to 16 by 4·5 cm., distinctly pointed at apex

and decurrent at base, texture rather tough when dry: petiole and sheath together 5–10 cm. long.

Perak. Temango, Ridley 14422. This agrees very closely with the Pahang specimen in inflorescences and flowers. I think Ridley was right in ranking it a variety; but quite wrong in identifying it with *G. minor* Bak., which from descriptions must be quite different.

3. **Scaphochlamys longifolia** (Ridl.) Holtt., **comb. nov.** *Gastrochilus longifolius* Ridl., Flora Mal. Pen. 4: 252. 1924.

Rhizome slender, creeping. *Leaf-shoots* with one leaf and a few bladeless sheaths. *Leaf-blade* to about 23 by 7·5 cm., slightly asymmetric, elliptic, with shortly acuminate apex and cuneate base slightly decurrent, hairy on the midrib beneath; petiole slender, about 15 cm. long, hairy; sheath about 5 cm. long. *Scape* of inflorescence slender, to 7 cm. long, hairy. *Inflorescence* ovoid, about 3·5 cm. long and 2 cm. wide. *Bracts* to about 2·5 cm. long and to about 8 mm. wide near base, tapering to acute apex, thin, ribbed when dry, short hairy throughout, each with one flower. *Bracteoles* c. 5 mm. longer than bracts, also hairy, with inflexed edges. *Flower* white, rather small, lip bilobed with rounded lobes.

The type of this species was collected at Ulu Gombak in Selangor by Ridley and is not represented in Singapore. Another collection from Ulu Gombak (Hume 9115, Herb. F.M.S. Mus.) agrees well with the description so far as vegetative parts go and has been stated by Ridley to be probably this species. The dimensions and details of the inflorescence are taken from this specimen, which however does not show details as clearly as one could wish.

If my observations are correct, this species agrees with *S. biloba* in its narrow one-flowered bracts with longer bracteoles but differs in the proportionately narrower leaves which have no white bands on the upper surface and probably in smaller flowers. Pending more information the two should be kept separate.

4. **Scaphochlamys sylvestris** (Ridl.) Holtt., **comb. nov.** *Curcuma sylvestris* Ridl. Trans. Linn. Soc. 3: 378. 1893. J.S.B.R.A.S. 32: 121. 1899. *Hitcheniopsis sylvestris* Ridl., Flora M. P. 4: 253. 1924.

Rhizome creeping, about 6 mm. thick when dry; intervals between leaf-shoots about 3–5 cm. *Leaf-shoots* short, each usually bearing one leaf and a few bladeless sheaths, the longest sheaths to about 14 cm. long. *Leaf-blade* purple beneath, green above, to about 26 by 12 cm., narrowly ovate, very shortly acuminate, base rounded to subcordate, hairy on the midrib beneath; petioles to about 45 cm. long, slender; sheath about 3 cm. long; ligule-lobes hardly raised above attachment of sheath. *Scape* slender, about 15 cm. long. *Inflorescence* ovoid or ellipsoid, to about 5 cm. long and 2·5–3 cm. wide, of many imbricating bracts, slightly squarrose. *Bracts* glabrous, to about 2·5 cm. long and 1·5 cm. wide, elliptic, the mucronate apex tinged with red, curved outwards, the edges thin but not

crisped, folded almost together near the apex; each bract with c. 3 flowers. *First bracteole* 1·8 cm. long, 1 cm. wide when flattened; second 1·4 cm., 5 mm. wide when flattened. *Calyx* with ovary 1·1 cm. long. *Corolla-tube* somewhat shorter than bract; lobes white, about 1·2 cm. long. *Staminodes* white, about as long as corolla-lobes, oblong with rounded ends. *Labellum* a little longer than corolla-lobes, oblong-obovate with bilobed apex, white with yellow median patch with violet streaks on either side of it. *Filament* short; anther 3 mm. long; pollen-sacs with short acute free basal ends; crest broad, recurved, violet.

This species has been only found in Pahang, near the Tahan River and its tributary the Teku, and on G. Tapis. It is distinct in its long-stalked short inflorescence with broadly elliptic shortly reflexed acute bracts, and small flowers with violet markings on lip and violet anther-crest. The G. Tapis specimen is similar vegetatively and in inflorescence to the others, but the only colour notes are "flowers pale yellow." It might be a colour variety.

SPECIMENS. *Pahang.* Tahan River woods, Ridley 2400 (type). Teku River, 1,500 feet, S.F.N. 8104 (Haniff and Nur); S.F.N. 31707 (Kiah). G. Tapis ridge, near Kuantan, 2,700 feet, S.F.N. 28813 (Symington and Kiah).

5. **Scaphochlamys oculata** (Ridl.) Holtt., **comb. nov.** *Gastrochilus oculata* Ridl., J.S.B.R.A.S. 32: 117. 1899. Flora 4: 251.

Rhizome slender, long-creeping, up to about 10 cm. between leaf-shoots. *Leaf-shoots* each with one leaf and a few bladeless sheaths; longest sheath about 10 cm. long, glabrous or slightly hairy. *Leaf-blade* to 23 by 12 cm. or to 25 by 8 cm., practically glabrous, flushed with purple on the lower surface, usually widest near the base, base rounded to cordate and somewhat decurrent on the petiole, apex broadly pointed, not or slightly acuminate; petiole to about 28 cm. long, glabrous; sheath about 5 cm. long. *Scape* of inflorescence 2–5 cm. long, slender, short-hairy towards apex. *Inflorescence* ovoid, compact, to about 5 cm. long and 2·5 cm. wide, with about 15 closely imbricating bracts. *Bracts* about 2·7–3·5 cm. long, to about 1·5 cm. wide, ovate, blunt, almost glabrous, with narrow thin smooth edges, the apex slightly spreading but not recurved; each bract containing about 3 flowers. *Bracteoles:* first to 2·5 cm. long and 1·2 cm. wide, 3-lobed; 2nd to 2·2 cm.; 3rd to 1·8 cm. *Calyx with ovary* c. 1·5 cm. long. *Corolla-tube* about 3 cm. long; lobes 1·5 cm. long, dorsal one 6 mm. wide at base, white. *Staminodes* white, as long as corolla-lobes, 5 mm. wide, with rounded ends. *Labellum* about 2·2 cm. long, bilobed nearly half-way to the base, 1·5 cm. or rather more wide, white with yellow centre and two crimson patches at the base. *Filament* 3 mm. long, broad; anther hardly 5 mm. long, bent forwards, pollen-sacs free at base; crest short, hardly reflexed, not wider than rest of anther.

This species is based on a specimen of Ridley's collected on the Pahang Track, Selangor, in 1897. A collection made in 1937 (S.F.N. 34353), also in Selangor, agrees well with the type, and includes alcohol material from which the above

measurements of the parts of the flower are taken. It is possible that the red spots on the lip may sometimes be absent.

S. oculata agrees with *S. biloba* in creeping habit with usually long-stalked single leaves, small short-stalked inflorescence, small anther-crest and flower-colouring. It differs however in the broader base to the leaf, and much wider bracts each containing 3 flowers. All specimens are from Selangor except one from north-western Johore.

It is possible that *S. concinna* (Bak.) and the present species should be united (see remarks under *S. concinna*), in which case *concinna* is the older name and should be used.

SPECIMENS. *Selangor.* Pahang Track, 1,500 feet, Ridley 8484 (type). Bukit Batu Berinding, Kanching, 800 feet, S.F.N. 34353 (Md. Nur). Pahang Track, Machado s.n. Semenyih, Hume 7900 (Herb. F.M.S. Mus.). *Johore.* G. Janeng, Lake and Kelsall s.n. 20.10.1892.

6. **Scaphochlamys pennipicta** Holtt., **sp. nov.**

Rhizoma tenuis, repens; *caules erecti* unifoliati, 3–10 cm. dissiti, vaginis paucis maximis 6 cm. longis obtecti; *folii lamina* ad 18 cm. longa et 7 cm. lata, vel ad 15 cm. longa et 7·5 cm. lata, leviter asymmetrica, elliptica, apice latissima brevissime acuta, basi cuneata-decurrens, supra atroviridis striis albis penniforme ornata, subtus rubro-purpurea, glabra; *petiolus* cum vagina 7–10 cm. longus; *vagina* verisimiliter brevis; *scapus* 4–6 cm. longus, tenuis; *inflorescentia* ovoidea, compacta, c. 1·8 cm. longa et 1·2 cm. lata; *bracteae primariae* tenues, apice excepta glabrae, c. 1·3 cm. longae, fere ad 1 cm. latae, ovatae, brevissime apiculatae, apicem versus leviter recurvatae, flores duos (vel unum ?) complectentes; *bractea secundaria* prima 12 mm. longa, tenuissima; *calyx* cum ovario c. 10 mm. longus; tubus *corollae* quam calycem 3 mm. longior, lobi 8 mm. longi, albi, lobus dorsalis latus; *staminodia* quam lobum dorsalem corollae breviora et angustiora, alba; *labellum* album (fascia lutea medio ornatum ?), 10 mm. longum vel paulum longius; *filamentum* brevissimum; *anthera* 3 mm. longa, crista parva, reflexa, quam antheram haud vel paulum latior. TYPUS: Pahang, Fraser's Hill, 4,000 feet, S.F.N. 11181, leg. Md. Nur.

In habit and in colour of leaves (with their feather-like white markings), this species resembles *S. biloba*, but it has much smaller bracts and flowers, the outer bracts at least have two flowers each in their axils, and the bracteole is not longer than the bract. The only known collection is the type.

7. **Scaphochlamys atroviridis** Holtt., **sp. nov.**

Rhizoma repens; *caules erecti* 1·5 cm. vel minus dissiti, unifoliati, vaginis pluribus maxima 4–5 cm. longa breviter pilosis plus minusve purpureo-sufflectis obtecti; *lamina folii* tenuis, supra atroviridis, infra pallidior et sparse pilosa, c. 14–20 cm. longa et 6–9 cm. lata, apice rotundata, basi late cuneata et leviter decurrens; *petiolus* cum vagina 6–10 cm. longus, vagina plerumque 1·5 cm. longa; *scapus* 3–5 cm. longus,

glaber vel subglaber; *rachis* 2–5 cm. longa, plus minusve flexuosa, bracteas 4–7 ferens; *bracteae primariae* virides vel basin versus rubro-sufflectae, patentes, angulo axillare c. 45°, basi concavae, alabastra florum 2–5 complectentes, apicem versus fere planae, marginibus firmis late undulatis non crispatis, c. 3–3·5 cm. longae, ad 1·5 cm. latae, explicatae ellipticae, apice rotundatae vel obtusae apiculo minuto hirsuto instructae, cetera fere glabrae; *flores* odorati, labello excepto albi: *bractea secundaria* prima c. 1 cm. longa, ceterae ad 5 mm. longae, late obliquae, apiculatae; *calyx* cum ovario 1·3 cm. longus; *ovarium* glabrum; *corollae* tubus ad 2·5 cm. longus, lobi 14–15 mm. longi, subaequales, basi 4 mm. lati; *staminodia* lobis corollae aequilonga, fere oblonga, e basi fere ad apicem rotundatum leviter dilatata, 5 mm. lata; *labellum* c. 18 mm. longum, 15 mm. latum, dimidio bilobum, lobis rotundatis imbricatis, medio fascia pallide lutea utroque latere striis lilacinis instructa ornatum, basi macula pallida lilacina utrinque prope filamentum instructum; *filamentum* 3 mm. longum; thecae 3 mm. longae; *crista connectivi* reflexa rotundata, leviter trilobata, lobo intermedio maximo, explanata c. 4 mm. longa et lata; *fructus* ellipsoideus, 12 mm. longus, 7 mm. latus. TYPUS: *Trengganu*, Kemaman, Bukit Kajang, 500 feet, S.F.N. 30240, leg. Corner 4.11.1935.

This species is closely allied to *S. malaccana* but distinct in its broad blunt short-stalked leaves, very dark green, one on each branch of the sympodium, and in shorter inflorescences. A specimen from Bukit Kedondong, Malacca, collected by Derry in 1890 and cultivated in Singapore, is almost exactly similar to the Kemaman plants; a coloured drawing of it was made from a potted plant.

The above description is prepared from the type collection (dried plants and flowers in alcohol) and Corner's field notes.

8. **Scaphochlamys concinna** (Bak.) Holtt., **comb. nov.** *Kaempferia concinna* Bak., F.B. I. 6: 221. 1890. *Boesenbergia concinna* Schltr. Fed. Rep. 12: 316. 1913. *Gastrochilus concinnus* Ridl., J.S.B.R.A.S. 32: 116. 1899. Flora 4: 251.

Rhizome slender, creeping, the leafy shoots at least sometimes close together. *Leaf-shoots* 1-leaved, with a few bladeless sheaths, the longest 8 cm. long. *Leaf-blade* to 15 by 5 cm., widest near more or less cordate base, apex short-acuminate short-hairy on the midrib beneath; petiole slender, about 20 cm. long; sheath short. *Scape* 2·5–4 cm. long, slender, glabrescent. *Inflorescence* ellipsoid, compact, about 4 cm. long and hardly 2 wide (sometimes wider ?). *Bracts* red, 2·5–3 cm. long, to about 1 cm. wide at the base, narrowed gradually to acute apex, thin, with very thin edges, almost or quite glabrous, enclosing 2 flowers. *First bracteole* 2·2 cm. long, thin, about 7 mm. wide; second 1·5 cm. long. *Calyx* with ovary c. 1·2 cm. long. "Flower white, with dark red stripes inside" (probably on lip). *Anther-crest* small, entire (Baker).

The only known collection of this species is the type, from Ulu Bubong, Perak (King's Collector 10135) It is

very nearly related to *S. oculata* (Ridl.) but has unusually narrow leaves (apparently not purple beneath, but this is not certain) and narrower more acute bracts. I have not seen a flower, but the red markings agree with *S. oculata* and the short anther-crest. If further collections from Perak show the flower identical with Selangor specimens of *S. oculata*, and also leaves purple beneath with variation in width, I think the two species should be united, under the older name *concinna*.

9. **Scaphochlamys breviscapa** Holtt., **sp. nov.**

Rhizoma in sicco c. 4 mm. diametro, repens; *caules erecti* unifoliati, fere 2–3 cm. dissiti, vaginis obtecti, vagina maxima 14 cm. longa; *lamina* folii ad 26 cm. longa et 12·5 cm. lata, ovato-acuta, brevissime acuminata, basi rotundata et leviter decurrens, nunquam cordata, supra viridis, subtus pallidior nunquam purpurea, costa subtus plus minusve hirsuta; *petiolus* ad 35 cm. longus; *vagina* 2–3 cm. longa; *lobi ligulae* late triangulares, 4 mm. alti, adpresso-hirsuti; *scapus* 1–3·5 cm. longus, in juventute vaginis obtectus; *inflorescentia* compacta, ad 6 cm. longa et 2·5 cm. lata, ea *S. sylvestris* similis sed apices bractearum minus patentes; *bracteae primariae* brevissime hirsutae praesertim prope basin et margines, plus minusve rubro-tinctae, 2·5–3 cm. longae, ad 1·5 cm. latae, dense imbricatae, apicem versus leviter patentes marginibus inflexis, explicatae apice obtusissimae, marginibus tenuibus leviter crispatis; *bractea secundaria* prima c. 2·1 cm. longa, 8 mm. lata, ceterae fere aequilongae; *flores* 3 (vel 4 ?) pro bractea; *ovarium* breviter pilosum; *calyx* cum ovario 1·6 cm. longus, profunde fissus, apicibus propinquis haud distinctis; *corollae tubus* quam bracteam fere 8 mm. longior, lobi albi, 12 mm. longi, lobus dorsalis basi 5–6 mm. latus, lobi laterales angustiores; *staminodia* lobis corollae fere aequilonga, oblonga, apice rotundata, 5 mm. lata; *labellum* quam lobos corollae 6 mm. longius, obovatum, 1/3 basin versus bilobum, lobi rotundati imbricati, fascia pallide lutea utroque latere stria lilacina instructa, et striis lilacinis paucis patentibus, ornatum; *filamentum* 3 mm. longum; *anthera* 5 mm. longa, thecae basi acutae liberae, crista connectivi reflexa 4 mm. lata. TYPUS: *Trengganu*, Kemaman, Ulu Bendong, 700 feet, S.F.N. 30021, leg. Corner 29.11.1935. "Very common on all hillsides but mostly sterile".

This species is known only from the type collection and is probably quite local in distribution, like its near ally *S. sylvestris*. It differs from *S. sylvestris* in the leaves being green beneath, with less broadly rounded and never subcordate base, in its short scape, somewhat narrower inflorescence, hairy bracts with less spreading and less acute tips and slightly crisped edges. The flowers appear to be practically identical; but I have seen only dried flowers of *S. sylvestris*. *S. breviscapa* is also nearly allied to *S. oculata*, but differs in the lilac (pale violet) lines on the lip (which has two red patches at the base in *S. oculata*) and the wider anther-crest which is also lilac.

10. **Scaphochlamys Kunstleri** (Bak.) Holtt., **comb. nov.** *Curcuma Kunstleri* Bak., F.B. I. 6: 214. 1890. Ridl., J.S.B.R.A.S. 32: 120. 1899. *Hitcheniopsis Kunstleri* Ridl., Flora 4: 252. 1924. *Gastrochilus ? Kunstleri* Valet., Bull. Buitenz. 2nd Ser. XXVII: 104, pl. 14. 1918. **Fig. 9, 10.**

Rhizome fleshy, underground; intervals between leaf-shoots to about 8 cm. *Leaf-shoots* with 2 large leaves and a few bladeless sheaths outside them; sheaths more or less flushed with purple, longest to 20 cm. long. *Leaf-blade* thin, more or less flushed with purple beneath (sometimes green), to about 45 by 18 cm., widest rather above the middle, apex rounded with an abrupt triangular tip 1 cm. long, base cuneate-decurrent, lower surface more or less hairy, the hairs fine, appressed and rather sparse; *petiole* and sheath together about 20 cm. long, petiole shorter than sheath. *Scape* c. 6–10 cm. long, glabrous. *Inflorescence* 6–10 cm. long, about 4 cm. wide, cylindric, the bracts with their broad upper edge spreading slightly, thus forming open pouches with the aspect of Curcuma. *Bracts* almost white or faintly greenish, edged with red or almost entirely flushed with crimson, about 2·8–3·3 cm. long, in the larger inflorescences wider than long, in the smaller almost or quite as wide as long, attached by a very broad base, sides imbricating closely near the base but not adnate, the apex very broadly rounded, the median line slightly outcurved so that each bract forms an open pouch. *Flowers* 3 to 6 in the axil of each bract. *Bracteoles:* first to 2·2 cm. long, rest gradually shorter. *Ovary* sometimes unilocular, with a basal group of c. 8 ovules, sometimes trilocular (fide Valeton). *Calyx* with ovary 1·5 cm. long. *Corolla-tube* a little longer than bract; lobes translucent white or pale buff, about 1·5–1·8 cm. long, the dorsal one 7 mm. wide at the base, narrowed to apex. *Staminodes* very pale orange buff, shorter and narrower than upper petal, puberulous, with translucent veins. *Labellum* about 2–2·3 cm. long, bilobed to about 1/3 of its length, very pale orange buff with a clear lemon yellow median band and sometimes pink streaks near the base on each side, the base rather deeply channelled, glabrous, the blade with translucent veins. *Filament* white, 3–4 mm. long; anther pale yellow or slightly suffused with pink, 6 mm. long, puberulous, crest very short, fleshy, emarginate, hardly reflexed.

This species appears to be common in some parts of Perak and has been many times collected. It was fully described for the first time by Valeton, from plants cultivated at Buitenzorg. His floral dimensions are larger than those given above, which are taken from Corner's specimen S.F.N. 31674; Valeton gives dorsal sepal 2 cm. long, lip 2·5 cm. There is variation in the amount of purple on the under-side of leaves, on sheaths and bracts, and in the pink veins of the lip (which are sometimes absent). Ridley gives a colour-variety *rubra*, as noted below. Valeton notes that some flowers examined by him had a trilocular ovary, some unilocular; all those examined by me (on one plant only) were unilocular.

SPECIMENS. *Perak.* Waterloo, 1,500 feet, common, Curtis 2719. Kinta, Curtis s.n. December 1895. Temango, Ridley 14425. Lenggong (cult. H.B. Singapore) Henderson s.n. June 1930. Upper Perak, 300 feet, Wray 3388, 3662, 3702. Lubok Merbau, S.F.N. 13592 (Burkill and Haniff). Sungei Siput, S.F.N. 6323 (Burkill). Larut, within 100 feet, King's Collector 2542. Gunong Tungul, Ridley 2778. Base of Gua Badak, Lenggong, S.F.N. 23840 (Henderson).

var. **rubra** Ridl., Flora, l.c. Staminodes, lip and anther dark red. Kuala Dipang, abundant, Curtis s.n. Oct. 1894. Tapah, Wray 193.

11. **Scaphochlamys perakensis** Holtt., **nom. nov.** *Curcuma lanceolata* Ridl., Mat. Fl. M.P. 2: 22. 1907. (Not *Gastrochilus lanceolatus* Ridl.). *Hitcheniopsis lanceolata* Ridl., Flora M.P. 4: 253. 1924.

Rhizome creeping, about 5 mm. thick when dry, bearing scale leaves c. 1·5 cm. apart; interval between leafy shoots up to 12 cm. or more. *Leafy shoots* with short stem bearing two leaves and sheaths outside them, and terminal inflorescence. *Leaf-blade* 25–45 cm. long, to 11 cm. wide (longest leaves not always widest), slightly asymmetric, widest above the middle, rather dark green above and paler beneath, apex acute but hardly acuminate, base very gradually narrowed and decurrent; petiole 10–30 cm. long, rather slender; sheath 10–15 cm. long; ligule-lobes broad, about 5 mm. long; thin. *Scape* 7–18 cm. long, slender, finely hairy when young, more or less glabrescent when old. *Inflorescence* ovoid when young, more or less cylindric when old; to 8 cm. long and 4 cm. wide, the bracts closely overlapping in their basal halves, the apices spreading. *Bracts* shaped exactly as in *S. Klossii*, green, sometimes with pinkish edges, 2·5–3 cm. long, to 1·4 cm. wide near the base, tapering to acute shortly apiculate apex, with thin much crisped edges 2–3 mm. wide, rather sparsely hairy (especially near edges and apex) when young, more or less glabrescent when old; each bract holding about 3 or 4 flowers. *First bracteole* 1·3 to 2 cm. long; others about 7 mm. (possibly more). *Calyx with ovary* 1·2 cm. long. *Corolla-tube* slender, 2 cm. or more long (apparently shorter than bract); lobes about 8 mm. long, white. *Staminodes* shorter than corolla-lobes, white, apparently reflexed. *Lip* a little longer than corolla-lobes, obovate, white, with pink markings on either side of the midline near the base and a median yellow patch near the apex; or sometimes without the pink markings. *Filament* short; anther 4 mm. long, the pollen-sacs with short free acute tips at the base; crest not much wider than anther, ovate-acute, short.

This species was described by Ridley from a collection made by Curtis on G. Bujong Malacca, accompanied by a pencil sketch and colour-notes. Curtis's specimens had only rather small ovoid inflorescences, the largest 4 cm. long. The bracts had pinkish edges. Other collections made later in the lowlands of Perak have exactly similar leaves and bracts but the inflorescences when fully grown are elongate to 8 cm.; and there is no further report of

pink-edged bracts. Ridley noted of his 14031 that the flowers were pure white. I think that all specimens represent one species, which is thus only known from Perak and is perhaps there localized. The dimensions of the flower given above are from a dried specimen (Ridley 14031), and from Curtis's drawing which shows the relative size of the parts. Ridley's name *lanceolatus* is already occupied in Scaphochlamys; a new one is therefore necessary.

SPECIMENS. *Perak.* G. Bujong Malacca, Curtis 2522 (type). Tapah, Ridley 14031. Without locality, Scortechini. S. Gepai, Bidur, S.F.N. 31690 (Corner).

12. **Scaphochlamys tenuis** Holtt.,**sp. nov. Fig. 11, B-F.**

Rhizoma supra terram, ascendens, radicibus brevibus graliformibus sustentus; *caules erecti* conferti, fere contingentes, bifoliati (raro unifoliati), vaginis obtectis, vagina maxima 9–10 cm. longa; *lamina* folii 15–19 cm. longa, 5–7 cm. lata, omnino viridis, glabra vel subglabra, leviter asymmetrica, elliptica, apice acuta, leviter acuminata, basi rotundata vel cuneata, leviter decurrens; *petiolus* tenuis, 15–20 cm. longus; *vagina* 3 cm. longa; *lobi ligulae* triangulares, paulum elevati; *scapus* c. 4 cm. longus, tenuis, glaber; *inflorescentia* 15–23 cm. longa, tenuis, bracteis 1·5–2 cm. dissitis, ad rachin appressis; *rachis* glabra leviter flexuosa; *bracteae primariae* virides, marginibus tenuibus brunneis non crispatis, 2–3 cm. longae, explanatae prope basin ad 1 cm. latae, apicem acutum versus angustatae, basi rachin amplectentes, 3–5 flores foventes; *bractea secundaria* prima 17 mm. longa, 6 mm. lata; *flores* leviter odorati, albi; *ovarium* glabrum, uniloculare, nonnunquam ovulum unicum donatum; *calyx* cum ovario 12–13 mm. longus; *corollae* tubus quam bracteam primariam c. 7 mm. longior, lobi 10 mm. longi; *staminodia* 3 mm. lata, lobis corollae paulum breviora; *labellum* album, fascia pallide lutea (non lilacino-marginata) ornata, 13 mm. longum, haud ad medium bilobatum, lobis rotundatis, imbricatis; *filamentum* 2 mm. longum; *anthera* 4 mm. longa; crista connectivi reflexa, 3 mm. lata, brevis, leviter trilobata, leviter lilacino-tincta; *stylodia* tenuia, acuta, 2·5 mm. longa; *fructus* ellipsoideus, 13 mm. longus, unilocularis, nonnunquam semen unicum fovens; semen 11 mm. longum, ellipsoideum. TYPUS: *Trengganu,* Kemaman Sungei Nipa, S.F.N. 30543, leg. Corner, 22.11.1935. "Common on the hillside by the camp, not seen elsewhere".

The above description was compiled from dried specimens, flower in alcohol, and Corner's field notes. The species is distinguished from all others by its very slender inflorescence with distant appressed bracts. It is nearly allied to *S. malaccana,* but has a much longer rachis and bracts that do not spread. The flowers also appear to be smaller than in *S. malaccana,* and the lip perhaps more deeply bilobed. The bracts of *S. tenuis* sometimes appear to be regularly two-ranked, but in other specimens are distinctly spiral in arrangement. Young leaves of *S. tenuis* may be flushed with purple on the lower surface.

13. **Scaphochlamys lanceolata** (Ridl.) Holtt., **comb. nov.** *Gastrochilus lanceolatus* Ridl., Mat. Fl. M.P. 2: 16. 1907. Flora 4: 250.

Rhizome creeping, of short elements (usually about 1 cm.) between successive leaf-shoots. *Leaf-shoots* short, of 1–3 leaves. *Leaf-blade* to 12 by 3–5 cm., slightly asymmetric, elliptic, apex blunt, upper surface light green barred with white, slightly hairy beneath; *petiole* to 2 cm. sheath to 3 cm. long, ligule-lobes triangular. *Inflorescence: peduncle* little over 1 cm. long; *rachis* very short, bearing about 5 overlapping sub-erect bracts. *Bracts* about 2·5 cm. long, almost glabrous, shaped as in *S. lancifolius*, the edges firm and not crisped, the apex apiculate. *Calyx* with ovary about 1·2 cm. long. *Corolla-tube* 2·7 cm. long. Rest of flower shaped as in *S. malaccana*, the petals about 1·3 (possibly 1·5 cm.) long and other parts in proportion; depth of lobing of lip uncertain; no information about colours on lip.

This species is only known from the type collection from G. Panti, Johore (Ridley s.n. Dec. 1892). It is nearly related to *S. malaccana;* whether the dwarf size and sessile inflorescences of the type collection are found commonly, or are only due to conditions of soil and exposure, is unknown. If the dwarf condition is characteristic, it is certainly a good species; if not, it may rank as a variety of *S. malaccana*. At present it is best kept as a distinct species.

14. **Scaphochlamys erecta** Holtt., **sp. nov. Fig. 12.**

Rhizoma erectus vel suberectus, in inflorescentia terminatus, folia disticha plurima c. 15 mm. utroque latere dissita, plerumque 8–10 simul expansa, ferens; ramus novus rhizomatis in axilla folii prope inflorescentiam oriens, primo vaginis obtectus, vagina maxima ad 10 cm. longa; *lamina folii* viridis, infra pallidior, 20–32 (–50) cm. longa, 3·8–5·5 (–7) cm. lata (folia breviora interdum 5 cm. lata), asymmetrica, anguste elliptica, apicem acutum (non acuminatum) versus sensim angustata, basi sensim angustata decurrens; *petiolus* 1–3 cm. longus; *ligula* cum marginibus vaginae tenuissima, ligula ut videtur longa sed plerumque rupta; *vagina* 6–9 (–15) cm. longa, basi breviter amplexicaulis; *scapus* plerumque 4–5 cm. (interdum ad 15 cm.) longus, subglaber; *rachis* inflorescentiae 4–5 cm. longa, 10–12 (interdum ad 25) bracteas imbricatas ferens; *bracteae primariae* 3–4 cm. longae, ad 14 mm. latae, ovatae, apice late acutae et breviter apiculatae, dorso fere glabrae, apiculo excepto, marginibus tenuibus, haud scariosis, minute crispatis, 2/3 basin versus inflexis, apicem versus solum patentibus, flores 2–4 foventes; *bractea secundaria* prima 2 cm. longa, ceterae 9 mm. longae; flores non odorati, albi; *ovarium* uniloculare, ovulis 3 basalibus donatum; *calyx* cum ovario 12 mm. longus, leviter inflatus, apice breviter dentatus, glaber; *corollae* tubus 2·8 cm. longus, tenuis, apicem versus leviter dilatatus, lobi 1 cm. longi, lobus dorsalis basi 4 mm. latus, apice acutus, lobi laterales leviter angustiores; *staminodia* 8 mm. longa, oblonga, apice rotundata, 4 mm. lata, patentia; *labellum* 13 mm. longum, 12 mm. latum, obovatum, tertia parte bilobatum (lobis rotundatis imbricatis), album, medio

fascia lutea basin versus lilacino-marginata ornatum; *filamentum* 2·5 mm. longum; *anthera* 3 mm. longa, thecae basi liberae, acutae, crista connectivi reflexa, rotundata, 3 mm. lata, haud 2 mm. longa; *stylodia* tenuissima, ad basin libera, 4·5 mm. longa; *fructus* unilocularis; *semina* 1–3, ellipsoidea. TYPUS: *Johore.* Sungei Sedili, Mersing Road, S.F.N. 31941, leg. Corner 30.8.1936.

Plants of this species grow erect in the thick and constantly renewed layer of decaying leaves on the forest floor; they appear to differ from *S. malaccana* and *S. Klossii* in having longer intervals of vegetative growth between successive inflorescences. The result is that the new element of the sympodium arises in the axil of a foliage leaf, not of a scale or sheath at the base of the previous leaf-shoot. The number of flowers in the axil of each bract appears to be less than in *S. Klossii,* and the hairiness of the bracts much less. The flowers are very similar to those of *S. Klossi.* The leaves are proportionately narrower than in *S. Klossii,* with long-decurrent bases as in *S. grandis.*

15. **Scaphochlamys Klossi** (Ridl.) Holtt., **comb. nov.** *Gastrochilus Klossii* Ridl., Mat. Fl. M.P. 2: 16. 1907. Flora 4: 248. *Boesenbergia Klossii* Loes., Pflanzenfam. Ed. 2. 15A: 571. 1930. **Fig. 13.**

Rhizome creeping or somewhat ascending, elements short; successive shoots rather close together, each with 4–6 or more leaves and a terminal inflorescence. *Leaves:* blade slightly fleshy, dark green above, pale green and more or less hairy beneath, 20 by 5 to 30 by 10 cm., elliptic or widest above the middle, often somewhat asymmetric, narrowed gradually to the decurrent base and more abruptly to the shortly pointed apex; *petiole* 1–10 cm. long, more or less winged and grooved, more or less hairy beneath; *ligule* lobes broad, triangular, 6–10 mm. long; *sheaths* with broad thin appressed-hairy edges, to 15 cm. long. *Scape* of inflorescence about 2–6 cm. long, finely hairy. *Inflorescence* ovoid to ellipsoid, acute, commonly to about 9 cm. long and 2·5–3 cm. in greatest thickness, exceptionally to 8 cm. long; bracts closely imbricating, usually quite obscuring the rachis, but more lax in the long inflorescences. *Bracts* green, more or less densely hairy all over but especially on the thin edges, (the hairs fine, appressed) narrowly ovate, acute, 2·7–3·5 cm. long, 1–1·4 cm. wide, the marginal 2–4 mm. thin and finely crisped; edges inflexed to the apex. *Flowers* about 3–8 in the axil of each bract, arranged in a 2-ranked partial inflorescence, the whole enclosed by a second bract 1·8–2·2 cm. long with inflexed edges which just meet at the base, and each flower with a much shorter bracteole. *Bracteoles* usually 6–8 mm. long, oblong-mucronate, with one or two prominent costae and smaller veins, more or less hairy; in some specimens with few-flowered partial inflorescences the bracteoles may be up to 1·2 cm. long. *Ovary* finely hairy; calyx with ovary 0·8–1·2 cm. long, calyx thin, tubular, irregularly toothed. *Corolla-tube* slender, about 1·8 cm. long; lobes white, about 7 mm. long and 4 mm. wide, the dorsal one with an acute apex. *Staminodes* about as long as corolla-lobes, 5 mm. wide, the rounded ends slightly reflexed,

white. *Lip* about 1·2 cm. long and wide, almost round, slightly bilobed with rounded reflexed hardly crisped lobes, white with pale lilac lines especially near the top of the throat and a median longitudinal pale lemon yellow band. *Filament* very broad, about 2 mm. long; *anther* about 3 mm. long, the pollen-sacs free and pointed at the base, the connective prolonged at the apex to a reflexed crisped and slightly lobed crest 3 mm. wide and 2 mm. long. *Fruit* ellipsoid, about 1·2 cm. long, containing 1–3 seeds; seeds ellipsoid with aril laciniate to the base.

This is a variable species, found only in the S. Sedili and G. Panti district of S.E. Johore. The typical form (i.e. that of the type specimen) grows rather large, always with several leaves on each new shoot, the sheaths broad and long and very hairy (appressed hairs) and the petiole never very long. The bracts are very hairy and the inflorescence fairly large, ovoid and very compact when young.

Corner notes on his no. 28965 "common in the swampy forest round the Sedili and tributaries, generally gregarious in damp hollows."

Specimens of Typical Form. *Johore.* Near G. Panti, Kloss s.n. 1905 (type). S. Kayu (S. Sedili), S.F.N. 31963 (Ngadiman) Without exact locality, S.F.N. 29983 (Corner). S. Berassau, Mawai-Jemaluang Road, S.F.N. 28965 (Corner). 14th mile Mawai-Jemaluang Road, Corner s.n. 14.5.1935. G. Muntahak, 600 feet, S.F.N. 19952 (Holttum).

var. glomerata Holtt., **var. nov.**

Caules paucifoliati, conferti; lamina folii ad 20 × 7 cm.; vagina folii 5–8 cm. longa; bracteae subglabrae, flores c. 7 foventes, marginibus bractearum leviter crispatis; folia interdum linea argentea prope marginem ornata. *Type.* G. Panti, West, low elevation, S.F.N. 30952 (with silver band on leaf, type of var.), S.F.N. 30951 (leaves pale green), both coll. Corner, 14.4.1936. This variety appears very distinct in habit, but this might be due in part to somewhat dry conditions of growth.

var. minor Holtt., **var. nov.**

Planta omnino parva; lamina folii ad 20 × 5 cm.; petiolus tenuis; inflorescentia laxa, ad 8 cm. longa (scapo incluso); bracteae paucae, 2–3 flores foventes. This variety appears fairly distinct, but the series is evidently variable and this might be only an extreme form. Mr. Corner notes "common, often gregarious, in the swamp or on the hillsides. The flowers exactly as the large-leaved *G. Klossii* but always smaller inflorescences." *Type.* Ulu Segun, G. Panti, low to 800 feet, S.F.N. 30743 (Corner). Also Bukit Tinjau Laut, Ngadiman s.n. 5.8.1937.

16. **Scaphochlamys grandis** Holtt., **sp. nov.**

Rhizoma validus, in sicco ad 1 cm. vel ultra diametro, oblique ascendens, radicibus gralliformibus ad 30 cm. longis sustentus; rami rhizomatis utrinque folia 5 (vel ultra) et inflorescentiam terminalem ferentes; rami novi in axillo folii secundi vel tertii infra inflorescentiam orientes, primo vaginis

hirsutis ad 18 cm. longis obtecti; *lamina* folii ad 50 cm. longa et 10 cm. lata, supra viridis, subtus pallide viridis et in costam hirsuta, asymmetrica, latitudine maxima supra medium, apicem leviter acuminatum et basin versus sensim angustata, basi decurrens; *petiolus* brevis vel nullus; *ligulae* lobi lati, 10 mm. vel ultra alti, triangulares; *vagina* ad 18 cm. longa, marginibus latis tenuibus, breviter hirsuta; *scapus* ad 7 cm. longus, c. 4 mm. diametro, breviter lanato-hirsutus; *inflorescentia* 7–12 cm. longa, bracteis arcte imbricatis; *bracteae primariae* multi, in juventute virides, mox rubicundae, omnino breviter lanato-hirsutae, dimidio apicale patentes, marginibus tenuibus haud crispatis, 3·5–4·5 cm. longae, prope basin 12–16 mm. latae, apicem obtusum versus sensim angustatae, plerumque flores duos (interdum plurimos ?) foventes; *bractea secundaria* prima 2–2·2 cm. longa, dense hirsuta, secunda 8 mm. longa; *ovarium* hirsutum; *calyx* cum ovario 17–20 mm. longus; *corollae* tubus 4 cm. longus, lobi albi 16 mm. longi, lobus dorsalis haud 4 mm. latus; *staminodia* alba, lobo dorsale corollae aequilonga, 5 mm. lata; *labellum* 2·2 cm. longum, fere ad medium bilobum, lobis plerumque irregulariter crenato-incisis, medio fascia lata flava basin versus atrolilacina-marginata cum striis paucis lilacinis patentibus ornatum; *filamentum* 3 mm. longum; *anthera* (crista excepta) 5 mm. longa, crista pallide lilacina, valide reflexa (apice fere dorsum antherae attingente), marginibus erectis, 6 mm. lata; *stylodia* tenuia acuta, 4·5 mm. longa; *fructus* ellipsoideus, 16 mm. longus, nitens; *semina* 2 vel 3, nigra, ellipsoidea. TYPUS: *Trengganu,* Kemaman, Ulu Bendong, 700 feet, S.F.N. 30030, leg. Corner 30.10.1935. "Very abundant in swamps in stream valleys, the whole plant to nearly 100 cm. high".

This very fine species is nearly allied to *S. Klossii* in the form of its inflorescence and bracts, but is much larger vegetatively and has larger flowers with a much larger anther-crest. It is the largest species of Scaphochlamys so far known, and has only been found at Kemaman. The description is made from dried specimens, flowers in alcohol, and Corner's field notes.

17. **Scaphochlamys Burkillii** Holtt., **sp. nov.**

Rhizoma in sicco 6 mm. diametro, interdum ascendens et radicibus gralliformibus sustentus; *caules foliati* conferti, 1–3 folia ferentes, vaginis purpureis obtecti; *lamina folii* 15–20 cm. longa, 4–7·5 cm. lata, leviter asymmetrica, basin et apicem versus aequaliter angustata, apice acuta (non acuminata), basi cuneata-decurrens, subtus viridis (in juventute pallide purpurea) et leviter hirsuta; *petiolus* purpurascens, 2–5 cm. longus, canaliculatus; *lobi ligulae* breves, lati; *vagina* 6–10 cm. longa, marginibus latis tenuibus leviter hirsutis; *scapus* validus, hirsutus, 1 cm. longus, vaginis foliorum obtectus; *inflorescentia* 5–6 cm. longa, 2 cm. diametro, ellipsoidea, vaginis foliorum fere aequilonga; *bracteae primariae* confertae, imbricatae, apice leviter hiantes, non recurvatae, 2·5–3·5 cm. longae, ad 15 mm. latae, purpurascens, extus fere omnino hirsutae, capillis appressis tenuibus sparsis, medio crassae, marginibus tenuibus non crispatis, 4–5 flores foventes; *bractea secundaria* prima ad 2·8 cm. longa, firma, valide 2-carinata, triloba, lobo intermedio apiculo hirsuto 2 mm. longo donato; bracteae secundariae ceterae 11–12 mm. longae; *calyx* cum ovario 16

mm. longus, fissus 5 mm., dentibus brevibus, hirsutis, confertis; *corollae* tubus quam bracteam 10–15 mm. longior, lobi albi, 16–18 mm. longi, basi 4 mm. lati; *staminodia* quam lobos corollae breviora, eis aequilata, obtusa, alba; *labellum* c. 2·0 cm longum et latum, obovatum, usque dimidium bilobum, album, medio fascia pallide lutea, utroque latere lineis rubro-purpureis marginata, ornatum; *filamentum* 3 mm. longum; *anthera* (crista exclusa) 3·5 mm. longa; crista connectivi 4 mm. lata, reflexa, alba vel leviter purpurascens, rotundata. TYPUS: *Pahang*, Barlok, Bukit Kapis, 200 feet, S.F.N. 210, leg. Burn-Murdoch 21.6.1913. Also collected at Beserah, Pahang (S.F.N. 16133, Burkill and Haniff).

Plants of this species (probably collected at Kemaman by Corner) are in cultivation at Singapore, and the dimensions of the floral parts, and colour of leaves and bracts given above are taken from the living plants. The latter are smaller than the dried ones, with shorter leaf-sheaths and fewer bracts in the inflorescence, but agree otherwise. In its habit and in the appressed hairs on the bracts, *S. Burkillii* resembles *S. Klossii*, but the smooth-edged bracts are very different, and also the colour of the flowers.

18. **Scaphochlamys rubromaculata** Holtt., **sp. nov. Fig. 11, A.**

Rhizoma oblique ascendens, radicibus gralliformibus sustentus; *caules erecti* breves, conferti (nonnunquam haud 1 cm. dissiti), folia 1 vel 2 et vaginas plurimas ferentes, vaginae maximae ad 12 cm. longae, glabrae; *lamina folii* 15–20 cm. longa, 4·5–5 cm. lata, pallide viridis, infra pallidior, fere glabra, apice acuta non acuminata, basi cuneata et leviter decurrens; *petiolus* cum vagina 6–10 cm. longus; *scapus* 4–6 cm. longus, sparse hirsutus; *rachis* 4 cm. longa, glabra vel subglabra, leviter flexuosa, bracteas 6–8 ferens; *bracteae primariae* virides, patentes, angulo axillare c. 45°, 2·5–3 cm. longae, 12 mm. latae, explanatae ellipticae, marginibus basi inflexis, non tenerrimis, haud crispatis, apicem versus patentibus (lamina hinc fere plana), apice rotundata brevissime apiculata, flores 4 (vel plurimos) foventes; *bractea secundaria* prima 8 mm. longa, ceterae breviores; *corollae* tubus haud 2 cm. longus, lobi 8 mm. longi, angusti, albi; *staminodia* alba, 6 mm. longa et 2 mm. lata, patentia, leviter reflexa; *labellum* 11 mm. longum et 8 mm. latum, haud ad medium bilobatum, lobis rotundatis imbricatis, album, medio fascia pallide flava et basi utroque latere macula sanguinea ornatum; *filamentum* cum anthera c. 3·5 mm. longum, crista connectivi reflexa, rotundata, 2·5 mm. lata; *fructus* 12 mm. longus, ellipsoideus, pericarpio tenui; semina 10 mm. longa. TYPUS: *Trengganu*, Kemaman, Ulu Bendong, 700 feet, S.F.N. 30031, leg. Corner, 29.10.1935. Also same locality and date, S.F.N. 30011.

This species is closely allied to S. malaccana, but has shorter inflorescences and much smaller flowers with a red spot on each side of the yellow band at the base of the lip.

19. **Scaphochlamys malaccana** Bak., F.B.I. 6: 252. 1892. *Kaempferia malaccana* K. Schum., Pflzr. Zingib. 1904. *Gastrochilus scaphochlamys* Ridl., J.S.B.R.A.S. 32: 112. 1899. Flora 4: 250. *Boesenbergia scaphochlamys* Schltr, Fed. Rep. 12: 317. 1913. *Gastrochilus lancifolius* Ridl., J.S.B.R.A.S. 32: 112. Flora 4: 250. *Boesenbergia lancifolia* Schltr, l.c. 316. *Kaempferia lancifolia* K. Schum., l.c. 80.

Rhizome obliquely ascending and supported on stilt-roots, of elements c. 2 cm. long between the leafy shoots. *Leafy shoots* short, usually 2-leaved and with a terminal inflorescence; outer sheaths purplish (always ?). *Leaf-blade* usually about 20 by 4·5 cm. (to 6 cm.), slightly asymmetric, elliptic, narrowed to acute (not acuminate) apex and cuneate base, slightly hairy beneath towards the base; *petiole* to about 10 cm. long, rather slender; *ligule* small; *sheath* to about 6 cm. long, narrow. *Inflorescence* with slender and ± hairy scape 5–12 cm. long and 6–8 large bracts about 0·7–2·5 cm. apart, arranged spirally on a more or less flexuous slender rachis 8–10 cm. long which is exposed by the spreading bracts, each bract bearing 3–7 flowers in its axil. *Bracts* green, 3–5 cm. long, 1·2–1·7 cm. wide, elliptic when flattened, with rounded slightly apiculate apex and edges involute towards the base, of firm texture, softly hairy beneath at least near base and apex, glabrescent when old. *First bracteole* about 1·2 cm. long; rest much shorter. *Flowers* fragrant. *Calyx* with ovary c. 1·0 cm. long, tubular, slightly swollen, the teeth close together, split 3 mm. down the other side. *Corolla-tube* white, slender at base, widening towards the apex, c. 2·5 cm. long. *Lobes* white, about 1·3 cm. long, acute, 4–5 mm. wide at the base, edges inflexed towards apex. *Staminodes* white, as long as corolla-lobes, oblong with rounded tips, about 4 mm. wide. *Lip* white with a yellow median band, sometimes with a pale lilac or purple line on either side of it towards the base, obovate, deeply (nearly half-way) bilobed, the lobes rounded and slightly overlapping, to about 1·8 cm. long and 1·4 cm. wide. *Stamen:* filament barely 3 mm. long, broad; pollen-sacs about 3 mm. long, their basal ends free and acute; connective produced at the apex into a reflexed crest nearly 4 mm. wide and about 2·5 mm. long, rounded and slightly 3-lobed, the edge somewhat crisped.

This species is the type-species of the genus *Scaphochlamys*. It was described by Baker from specimens, in the Kew herbarium, collected on Mt. Ophir by Cuming, Griffith, Maingay and Hullett, none of which collections are represented in Singapore. We have however a collection by Ridley from the same locality (no. 3141) which agrees with Baker's description and from it the above description has been prepared. The bracts appear spathulate because of the inflexed edges in the basal part, but are really elliptic.

Gastrochilus lancifolius Ridl. is so nearly related to *S. malaccana* that I cannot see a clear distinction; the type has narrower acute bracts, but there are intermediates in

this character. I prefer at present to regard all as *S. malaccana*, noting that there is variation, and distinct varieties may later be recognized.

SPECIMENS. *Malacca.* Mt. Ophir, Woods below G. Mering, Ridley 3141. *Johore.* Bukit Muar, Fielding s.n. October 1892. Kuala Sembrong, Lake and Kelsall s.n. 1892 (type of *lancifolia*). *Negri Sembilan.* G. Angsi: Ridley s.n. February 1904; S.F.N. 9895 (Holttum); 2,600 feet, S.F.N. 11690 (Md. Nur). Senaling-Inas F.R., S.F.N. 9783 (Holttum).

20. **Scaphochlamys sub-biloba** (Burk. ex Ridl.) Holtt., **comb. nov.** *Gastrochilus sub-bilobus* Burk. ex Ridl., Flora M.P. 4: 250. 1924. Valet., Bull. Buitenz. 2nd Ser. XXVII: 87. 1918.

Rhizome creeping; successive elements very short, the leaf-shoots close together, touching. *Leaf-shoots* each with one or two leaves and several bladeless sheaths, the longest sheath to about 10 cm. long; sheaths apparently tinged with red. *Leaf-blade* 15–20 cm. long, 4–6 cm. wide (longest leaves not always widest), slightly asymmetric, elliptic, apex acute, rarely slightly acuminate, base cuneate and slightly decurrent, lower surface glabrous; *petiole* about 3–6 cm. long; *sheath* to 6 cm. long, rather narrow, glabrous. *Scape* about 3–7 cm. long, rather slender, short-hairy. *Rachis* 6–10 cm. long, more or less flexuous, hairy like the scape, bearing up to 12 spreading bracts which are about 6–12 mm. apart. *Bracts* 2·2–2·8 cm. long, 6–8 mm. wide when flattened, stiffly boat-shaped with the edges inflexed throughout, (not spreading towards the apex as in *S. malaccana*), elliptic, acute, hairy when young, sometimes glabrescent when old, edges thin but not crisped nor hairy; each bract with a group of several flowers in its axil. *First bracteole* about 1·3 cm. long; others shorter. *Corolla-tube* c. 2·5 cm. long; lobes about 1 cm. long, white. *Staminodes* about same length as dorsal corolla-lobe and about as wide, oblong, white. *Lip* a little longer, shortly bilobed, white with a median pale yellow band and no other colour.

This species is only known from Pulau Tioman. It is very closely related to *S. tenuis* of Kemaman but has a shorter inflorescence and spreading bracts. It differs from *S. malaccana* in its bracts being stiff and narrow, with inflexed edges throughout, and in having a less deeply lobed lip. The specimens are not all very satisfactory, and there is not a single well-preserved flower; the floral dimensions are therefore a little doubtful. Perhaps later collections will show that this species should be united to *S. tenuis*. As with *S. tenuis*, the bracts are brown when dry, not green like those of *S. malaccana*.

SPECIMENS. *Pulau Tioman.* Joara Bay, 0–1,000 feet, in deep shade, S.F.N. 1002, 1143 (Burkill). Ayer Surin, 1,000–2,000 feet, in rocky jungle, S.F.N. 21701 (Henderson). Near Tanah Runto, 1,200 feet, S.F.N. 18380 (Henderson).

6. BOESENBERGIA O. KUNTZE

Rhizome usually fleshy, of short elements between leaf-shoots. *Leaf-shoots* usually consisting of a short erect stem (rarely over 15 cm. tall) bearing 1 to 4 or occasionally more leaves with a few bladeless sheaths outside them at the base, and a terminal inflorescence. *Leaves* of moderate size, green, sometimes with purple sheaths; *petiole* (between blade and sheath) short or fairly long; *ligule* 2-lobed, the lobes usually about 5–10 mm. long, rounded or triangular. *Inflorescence* on a short peduncle above the insertion of the highest leaf, enclosed when young, or throughout, by the two uppermost sheaths; axis of inflorescence short or fairly long, bearing 2-ranked alternate bracts which overlap at the base on one face of the axis and not on the other. *Bracts* relatively long and narrow (about 2–6 cm. long), boat-shaped, each (except one or two at the apex) enclosing a single bracteole and a single flower; apical bracts maturing first, the others in succession from apex to base, the axis in some cases elongating during the process. *Bracteoles* nearly as long as bracts, with inflexed sides enfolding the flower, either narrower or wider than the bract. *Ovary* 3-locular with a few ovules in each loculus (in *B. Curtisii* six), or incompletely 3-locular with a basal group of ovules, or a group on a raised axile placenta. *Calyx* short, tubular, rarely almost as long as bracteole. *Corolla-tube* slender, usually a little longer than the bracts; *lobes* subequal, spreading obliquely or the lateral ones curved upwards. *Staminodes* more or less oblong, a little shorter to a little longer than corolla-lobes and of about the same width, their ends usually broadly rounded and slightly reflexed, white, pink or yellow. *Labellum* longer than corolla-lobes and staminodes, sometimes basin-shaped, sometimes not very concave, rarely if ever bilobed, the apical margin more or less crisped, white or variously marked with red and/or yellow. *Stamen* with relatively narrow filament about as long as anther; anther with parallel pollen-sacs not free at the base, opening by slits or in *B. Curtisii* by apical pores; connective either produced into a short narrow crest or not at all produced apically. *Stylodes* slender, of moderate length. *Fruit* ellipsoid, thin-walled, sometimes unilocular; seeds relatively large, ellipsoid, black, with a white aril as long as, or longer than the seed, laciniate to the base.

Type species: *Gastrochilus pulcherrima* Wall.

Wallich established a genus Gastrochilus in his *Plantae Asiaticae Rariores* (1828), though he noted at the time the prior existence of another genus (family Orchidaceae) of the same name, published by Don in 1825. Don's genus

was ignored by later botanists, his species being usually included in Saccolabium Bl. But when Schlechter and Smith came to study the wealth of species in the Saccolabium group and defined a number of distinct genera, they found the necessity of reviving Don's name, as his species belonged to one of the genera in question, not to Saccolabium Bl. In any case, Gastrachilus Wall. is by the present rules invalid, being a later homonym, a fact which had been noted by O. Kuntze, who proposed the name Boesenbergia in its place. In transferring certain orchids to Gastrochilus Don, Schlechter pointed out the necessity of using Boesenbergia for Wallich's Zingiberaceous genus, and transferred to Boesenbergia all species then included in Gastrochilus Wall. Loesener and other botanists subsequently transferred other species.

But until Valeton's paper of 1918, no botanist had made any satisfactory comparative study of Kaempferia and allied genera, and no two authors had agreed about the limits of Gastrochilus Wall. Indeed, many species were so inadequately described that, when Valeton had prepared his new diagnosis of Gastrochilus Wall., it was in many cases uncertain whether a species belonged to it or not, and Loesener could not use Valeton's definition effectively. The substitution of the name Boesenbergia for the name Gastrochilus did nothing to clarify the situation, and only involved the publication of a certain number of quite unnecessary new binomials.

Wallich's original species of Gastrochilus were *G. pulcherrima* and *G. longiflora*, both illustrated by coloured plates. The former has rather tall leafy stems with a terminal inflorescence of 2-ranked bracts, having the peculiar character of maturing from the apex downwards. This structure is well shown by Wallich's plate and has been clearly described by Valeton. It is very peculiar, and is shared by a number of other species. I take *G. pulcherrima* as the type of the genus Boesenbergia. Some other species have a much more condensed inflorescence, but of the same structure.

Wallich's second species has been less clearly described. He stated that there were one or two flowers to each bract; but his drawing of part of the inflorescence does not show the arrangement at all clearly. The inflorescences are shown as separate leafless branches, outside the group of leaves, a character not shown by any Malayan species allied to *B. pulcherrima*. The inflorescences also appear to have spirally arranged bracts. In the Botanical Magazine t. 4010, is an illustration which does not agree very well with Wallich's. The bracts appear to be arranged in two ranks.

like those of *B. pulcherrima*, but are on separate shoots, enclosed by green sheaths, not by the sheaths of foliage leaves; the number of flowers to each bract is not stated. In view of this lack of information, the status of *Gastrochilus longiflora* must remain uncertain. If Wallich's information should prove inaccurate, it may yet prove to belong to Boesenbergia as now defined; or it may have to be transferred to another genus.

Boesenbergia, as here limited, is a genus of Indo-Malaysia, probably having its greatest abundance of species in Western Malaysia. As noted above, owing to inadequate descriptions of the inflorescence, the number of species named in herbaria is uncertain. The genus is much less polymorphic in Malaya than Scaphochlamys, and the species are in several cases widely distributed, in contrast to the very local occurrence of most Scaphochlamys. *B. pandurata* is widely cultivated and used as a flavouring for food.

KEY TO MALAYAN SPECIES OF BOESENBERGIA

Stem slender, 30 cm. or more from base to top of uppermost sheath; leaves about 6, spaced on upper part of stem; petioles 1–1·5 cm. long 1. *B. pulcherrima.*

Stem shorter (usually much shorter); petioles longer

Inflorescence elongating and much exserted when fully grown, not completely enclosed by the leaf-sheaths

Bracts 5–6 cm. long; lip not basin-shaped 2. *B. plicata.*

Bracts 2·5–3·5 cm. long; lip basin-shaped 3. *B. Prainiana.*

Inflorescence hardly elongating, the bracts not or hardly projecting beyond the protecting leaf-sheaths

Anther dehiscing by terminal pores 4. *B. Curtisii.*

Anther dehiscing by slits along whole length of pollen-sacs

Anther-crest small, more or less rounded, slightly retuse or with a short single tip

Petals 2–2·5 cm. long, yellow 5. *B. flava.*

Petals about 1 cm. long 6. *B. longipes.*

Anther-crest bilobed, lobes short, acute

Petals and staminodes pink; lip not yellow 7. *B. pandurata.*

Petals and staminodes white; lip with yellow centre 8. *B. clivalis.*

1. **Boesenbergia pulcherrima** (Wall.) O. Ktze. Rev. Gen. Pl. 685. 1891. *Gastrochilus pulcherrima* Wall., Pl. Asiat. Rar. 1: 22, t. 24. 1829. Bot. Mag., t. 3930. Ridl., Flora 4: 247.

Stem slender, 30 cm. or more from base to top of uppermost leaf-sheath. *Leaves* about 6, spaced along the stem except near base; *blade* about 14 by 3·5 cm., elliptic, shortly acuminate, base cuneate and decurrent; petiole 1–1·5 cm. long; ligule-lobes about 4 mm. long. *Inflorescence* terminal, bracts close together, at first almost entirely enclosed by the last leaf-sheaths, somewhat exserted later as rachis elongates. *Bracts* 3 cm. (3·5 cm. ?) long. *Corolla-tube* as long as bracts; lobes subequal, straight, about 1 cm. long, the laterals on either side of the base of the lip, white. *Staminodes* about 3 mm. longer than dorsal corolla-lobe, about 4 mm. wide, their apices not or little reflexed, white. *Lip* c. 1·5 cm. long, strongly basin-shaped with edges reflexed and crinkled towards the apex, white flushed with red in the middle at the apex, the red area extending, narrowed, towards the base. *Filament* about 6 mm. long; anther about 5 mm., with parallel pollen-sacs and a very short crest.

Government Hill, Penang, cult. in Waterfall Gardens, flowered September 1898, leg. C. Curtis, with drawing.

This specimen was labelled *Gastrochilus albo-sanguinea* Ridl., but differs entirely from that species in its vegetative habit, with slender stem, smaller short-stalked leaves, and in its much smaller flowers with the lateral petals not upcurved nor the upper one incurved.

The drawing and specimen agree very closely with *B. pulcherrima* as illustrated in Bot. Mag. t. 3930. The specimen shows the bracts little exserted from between the uppermost leaf-sheaths, but it would probably elongate later, as shown in Wallich's original figure, in the same way as the inflorescence of *B. plicata* and *B. Prainiana*. The species is probably at the southern limit of its range on Penang Hill (as some other northern plants) and is evidently not common, as it has never been collected again.

2. **Boesenbergia plicata** Holtt., **comb. nov.** *Gastrochilus plicatus* Ridl., J.S.B.R.A.S. 44: 196. 1905. Flora 4: 247.

Erect stem very short, bearing 3–5 leaves. *Leaf-blade* green, plicate, to about 40 by 14 cm., ovate, apex shortly pointed, base broadly cuneate to subcordate; *petiole* above sheath to about 12 cm.; *sheath* 10–15 cm. long, ligule conspicuously bilobed, thin, lobes rounded; old sheaths red-brown. *Inflorescence* from stem apex, emerging from between the leaf-sheaths and elongating to nearly 30 cm. in all; *scape* slender, about 3–7 cm. *Primary bracts* alternate 2-ranked, the bracts in each rank about 1 cm. apart, all facing one way, 5–6 cm. long and hardly 1 cm. wide, acute, green, minutely hairy, each with a single bracteole and a single flower. *Bracteoles* as long as bracts, with the edges much infolded, when flattened 1·7 cm. wide, glabrous, firmly papery

when dry. *Ovary* glabrous, cylindric, 5 mm. long at flowering, incompletely 3-locular, with c. 10 ovules. *Calyx* (not including ovary) 1 cm. long, very thin, lobes short and broad. *Corolla-tube* slender, 3–5 cm. long (thus shorter than bract); the flower emerging below the apex of the bract and bracteole. *Corolla-lobes* cream with red streaks, dorsal 2·3 by 1·0 cm., lateral 2·1 by 0·8 cm. *Staminodes* cream, narrowly obovate, about 1 cm. longer than the dorsal corolla-lobe and 1·3 cm. wide, joined to the stamen and lip in a funnel-shaped faux 7–8 mm. deep beyond the insertion of the corolla-lobes. *Labellum* about 3·2 cm. long and nearly 2 cm. wide, obovate, the basal part with sides upcurved and overlapping the staminodes, the broad apex spreading, with crinkled edges, cream to pale greenish yellow with deep crimson patch at the base, extending forwards more or less continuously to the middle of the lip. *Filament* narrow, 1·2 cm. long; anther cream, 1·1 cm. long, the connective not extending beyond the tips of the pollen-sacs. *Stigma* small, the aperture broadly elliptic. *Stylodes* 6 mm. long. *Fruit* not known.

This species is apparently not uncommon in lowland forest in Malaya, at least on the eastern side of the country. There seems to be some variation in the colour of the flower and the distribution of red on the lip. There may also be variation in the length of the connective at the apex of the anther. The species is no doubt closely allied to *B. pandurata* (Roxb.) Schl. (native of Sumatra) but *B. pandurata* never has an elongate inflorescence and the staminodes are shorter than the corolla-lobes. The Langkawi specimen referred to *B. pandurata* by Ridley has a long inflorescence; I think there is no doubt it is *B. plicata* var. *lurida* (see below).

Specimens. *Trengganu.* Ulu Brang, 350 feet, S.F.N. 33864 (Moysey). *Kelantan.* Kuala Lebir, Gimlette s.n. 1904 (type, with coloured drawing from cult. plant). Bukit Batu Papan, S. Lebir, S.F.N. 29558 (Henderson). S. Ketil at Gua Musang, S.F.N. 22658 (Henderson). Sungei Keteh, S.F.N. 12035 (Md. Nur). Kuala Krai, S.F.N. 10119 (Haniff and Nur). *Perak.* Temango, Ridley 14424. *Pahang.* Sungei Sat, Ulu Tembeling, S.F.N. 21988 (Henderson). P. Tioman, G. Rokam, 2,700 feet, S.F.N. 18800 (Md. Nur); Sungei Tawar, Joara Bay, S.F.N. 1009 (Burkill). *Johore.* Base of G. Panti, Ridley s.n. December 1892.

var. lurida (Ridl.) Holtt. **stat. nov.** *Gastrochilus luridus* Ridl., Mat. 2: 17. 1907. Flora 4: 248. *Boesenbergia lurida* Loes., Pflanzenfam. Ed. 2, 15A: 570. 1930.

Leaves somewhat smaller than in typical form. *Bracts* flushed with red or purple. *Flowers* almost completely flushed with red, from a light pink to orange-scarlet, paler towards the base of lip and staminodes.

This variety is only known to occur in Langkawi. It was described by Ridley from a drawing made at Penang from a cultivated plant. The colour of the flower there shown is a dull pink whence the name *lurida*, but the Penang drawings were often inaccurately coloured. The bracts are

shown as dull dark purplish. Holttum's specimen has the field note "flowers bright orange red, petals paler at base" (petals here indicate lip and staminodes). The shape of the flowers seems identical with typical *B. plicata*, but the Terutau specimen was said by Ridley to have had a linear crest to the anther, shown in his sketch as half the length of the pollen-sacs.

SPECIMENS. *Langkawi.* S.F.N. 17410 (Holttum). Curtis 2677. Haniff s.n. September 1900. Kuala Kuah, S.F.N. 7071 (Haniff and Nur). Hamad s.n. July 1892. *Terutau.* Curtis s.n. July 1889.

3. **Boesenbergia Prainiana** (Bak.) Schltr., Fed. Rep. 12: 316. 1913. *Kaempferia Prainiana* Bak., F.B.I. 6: 220. 1892. *Gastrochilus Prainiana* Ridl., J.S.B.R.A.S. 32: 115. 1899. Flora 4: 248. *Gastrochilus albo-sanguinea* Ridl., J.S.B.R.A.S. 32: 111. 1899. Flora 4: 247. *Boesenbergia albo-sanguinea* Schltr. l.c. 315.

Stem short (rarely 10 cm. to base of last leaf), bearing 1–3 leaves or rarely more (usually one only) and a few bladeless sheaths; sheaths finely mottled with red. *Leaves:* blade to about 25 by 12 cm., nearly elliptic, apex shortly pointed, base cuneate to rounded and slightly decurrent, lower surface purplish towards apex and bearing rather sparse very fine hairs; petiole to about 9 cm. long; ligule-lobes about 2 mm. long; sheath 5–10 cm. long or rarely longer. *Inflorescence* apical, appearing from within the innermost leaf-sheaths, elongating when fully grown to about 18 cm., the scape to about 8 cm. *Bracts* in 2 alternating rows, folded down the middle, pale green more or less mottled with fine dull red spots like the outer sheaths, 2·5–3·5 cm. long, 1 cm. wide when flattened, thin, acute, those in each row about 2 cm. apart when the inflorescence is mature. *Bracteoles* 3–5 mm. shorter than bracts, about 5 mm. wide when flattened. *Ovary* containing few ovules on an erect basal placenta, not completely 3-locular. *Ovary* c. 3 mm., calyx c. 6 mm. long at flowering. *Corolla-tube* as long as bract, or nearly as long, slender; lobes about 1·5 cm. long, subequal, white, the lateral ones curved upwards towards the dorsal, not beneath the lip. *Staminodes* white or slightly pink-tinged, about same length as dorsal corolla-lobe, about 5 mm. wide, apex broad and slightly retuse. *Lip* about 2·5 cm. long, 1·2 cm. wide in natural position, basin-shaped with crinkled reflexed rounded apical margin, white, the front edge blood-red with faint whitish stripes, the midline of the throat red-speckled, with a deep red spot near base of stamen. *Filament* 7 mm. long, anther 6 mm. long, without anther-crest. *Fruit* 2 cm. long, narrowly ellipsoid, surrounded by persistent bract and bracteole, glabrous, thin-walled when dry, unilocular, containing 1–3 seeds. *Seeds* narrowly ellipsoid, 1·3 cm. long and 0·3 cm. thick; aril about ¾ as long as seed, lacerate to the base in many narrow lobes.

This species was originally collected in Perak by Kunstler, and no other Malayan collections were recognized as such by Ridley, who however (in my opinion) re-described it as *G. albo-marginata*. Ridley also stated that

B. Prainiana occurs in Sumatra, upon what evidence I do not know. *B. Prainiana* has a habit closely similar to *B. plicata,* but shorter wider bracts more widely spaced, much narrower bracteoles, smaller flowers with relatively shorter staminodes, and deeply basin-shaped lip. It has been collected at several lowland localities on the east side of the Peninsula, twice in Perak and once in Langkawi (probably).

Ridley described *Gastrochilus albo-marginatus* from a plant cultivated at Penang, sent from Maxwell's Hill, Perak, by T. A. Wooldridge. There is a pencil drawing made from the living plant (dated September 1894), and colour notes by Curtis. Curtis also wrote "plant 12–18 inches high", which Ridley altered to "stem 12–18 inches tall", which the drawing shows to be a quite inaccurate statement. The dried specimen was cut off above the base, but by comparison with the drawing it is certain that the top of the longest leaf-sheath cannot have been more than 20 cm. above the base of the plant. It is likely that the extra length of stem and sheaths may have been due to conditions of cultivation. There is no other clear distinction from *B. Prainiana,* the inflorescence and flowers being identical with that species in every way.

There is also a specimen, accompanied by drawings, of a plant from Langkawi cultivated at Penang. This has leaves of similar shape, but with larger ligule-lobes (triangular, 5 mm. long) and shorter sheaths (longest apparently 10 cm.). It shows red bracts and a flower of similar appearance, with the corolla-lobes in the same curious arrangement, but the lip less distinctly saccate. The inflorescence is at an early stage and the spacing of the bracts cannot be judged.

SPECIMENS. *Perak.* Gopeng, King's Collector 726 (Type). Maxwell's Hill, per Wooldridge, cult. Penang (type of *G. albo marginata*). *Trengganu.* Bukit Kajang, Kemaman, 500 feet, S.F.N. 30209 (Corner). Ulu Brang, 350 feet, S.F.N. 33852 (Moysey). *Pahang.* Baloh, Bukit Kapis, 300 feet, S.F.N. 212 (Burn-Murdoch). *Johore.* S. Kayu Ara, Mawai-Jemaluang Road, Corner s.n. October 1935 (cult. H.B.S.). S. Buloh Kasap, Mawai-Jemaluang Road, Corner s.n. 5.1.1936. Bukit Tinjau Laut, S.F.N. 37052 (Ngadiman).

4. **Boesenbergia Curtisii** (Bak.) Schl., Fed. Rep. 12: 316. 1913. *Gastrochilus Curtisii* Bak., Bot. Mag. t. 7363. 1894. Ridl., J.S.B.R.A.S. 32: 1899. Flora 4: 249. Valet., Bull. Buitenz. 2nd Ser. XXVII: 93 (sub *G. javanum*). *G. acuta* Ridl., J.S.B.R.A.S. 59: 202. 1911. Flora 4: 249. *G. javanus* K. Schum., Pflanzenr. Zingib. 95. 1904. Valet. l.c.

Leafy stems short, each with about 4 leaves, the highest attached at 2–7 cm. above ground level. *Leaf blade* to 40 by 12 cm., slightly asymmetric, elliptic, shortly acuminate, the

base cuneate and more or less decurrent, the lower surface sparsely hairy, entirely green; petiole 5–15 cm. long, winged and grooved; ligule-lobes rather small; sheaths flushed or mottled with red-purple, very broad, at least in the basal part. *Inflorescence* when young completely enclosed by the upper two leaf-sheaths as in *B. pandurata*, when old swollen and separating the sheaths but not elongating, the axis very short, the bracts numerous and crowded. *Bracts* 4–5 cm. or rather more long, narrow; bracteoles of nearly equal size. *Ovary* 3-locular, with about 6 ovules in each loculus. *Calyx* with ovary narrowly tubular, about 3 cm. long. *Corolla-tube* slender, 6–7 cm. long; lobes 2–2·2 cm. long, subequal, spreading, narrowed to apex, white. *Staminodes* white with or without a bright red patch at the base, spreading, about 1·6 by 0·6 cm., the apex either narrowed or broadly rounded. *Labellum* about as long as corolla-lobes or a little longer, more or less elliptic, not at all concave, the sides spreading, sometimes reflexed towards the apex, apex somewhat reflexed, the whole white with a yellow patch at the apex and irregular red markings at the sides about the middle and towards the base, or without such marks. *Stamen* short, filament about 4 mm. long, anther 4 mm. long, bent forwards, the pollen-sacs opening by terminal pores; crest short, recurved, bilobed, the lobes ending in short teeth. *Stigma* raised well above the anther.

This species has been collected several times on limestone in the Langkawi Islands and Perlis, and once in Pahang. *G. javanum* (Schum.) Val., found in teak forests in Java, is evidently the same species. Valeton notes that the differences between *G. javanus* and *G. Curtisii* are few and not very important; and some of them prove non-existent upon examination of specimens of *B. Curtisii*. The calyx of the latter is not over ¾ as long as the bract in the specimen collected by me, and the shape of the staminodes is shown by three different drawings (made at Penang) to be variable, sometimes nearly pointed and sometimes with broad apex; the crest of the stamen is shown with sharp teeth as indicated in Valeton's figure. The only differences remaining are in the colour of the lip, which is stated by Ridley to be variable in Langkawi plants. I think therefore we may safely reduce Schuman's species to *B. Curtisii*. The occurrence in Pahang is interesting, and leads me to suspect that the species occurs also in Borneo. *G. acuta* Ridl. from Perlis is evidently the same species, only differing in the distribution of red on the lip.

Specimens. *Perlis.* Batu Bunga, cult. H.B.S., Ridley s.n. 1910 (type of *G. acuta* Ridl.). Bukit Rajah Wang, Ridl. s.n. 1910. Besih Hangat, S.F.N. 22874 (Henderson). Bukit Lagi, Henderson s.n. November 1929. *Langkawi.* Cult. Penang, September 1890, Curtis 2678, 2876. Telok Apam, S.F.N. 7494 (Haniff and Nur). Among limestone rocks near sea, S.F.N. 15094 (Holttum). *Terutau.* Curtis 1675. *Pahang.* Base of Bukit Sagu, S.F.N. 25086 (Henderson).

5. **Boesenbergia flava** (Ridl.) Holtt., **comb. nov.** *Gastrochilus flavus* Ridl., Flora Mal. Pen. 4: 248. 1924. *G.*

minor quoad Ridl., J.S.B.R.A.S. 32: 111 and Mat. 2: 17 (not of Baker).

Leafy stems short, each with about 4 leaves and red sheaths at the base. *Leaf blade* to 20 by 6 cm., somewhat asymmetric, elliptic, shortly pointed, base cuneate-decurrent, green with a median silvery band (the midrib and a band on either side of it); *petiole* 2–4 cm. long; *ligule-lobes* 1 cm. long, acute, thin, pinkish; *sheath* flushed or mottled with red almost throughout. *Inflorescence* entirely hidden by leaves, as in *B. pandurata* and apparently of similar construction. *Bracts* about 5 cm. long, flushed with pink. *Corolla-tube* 1–1·5 cm. longer than bract, slender; lobes yellow, 2–2·5 cm. long. *Staminodes* yellow with a red spot at the base of each, oblong, about as long as the petals. *Lip* 2·5–3 cm. long, to nearly 2 cm. wide, oblong-obovate, nearly flat, yellow with a deeper yellow patch near the apex and a band of red blotches on either side of the midline towards the base. *Filament* nearly 1·5 cm. long, pale yellowish ± flushed with pink, narrow; anther about 5 mm. long, the pollen-sacs somewhat diverging towards the apex; connective prolonged into a crest about 1 mm. long, not wider than the anther, slightly reflexed, with a very short tip.

This species was originally described by Ridley from a plant cultivated at Penang, brought from Batang Padang district (Perak); a coloured drawing exists in Singapore and also a dried specimen prepared from the plant drawn. Though describing this plant (as is clearly shown by comparison with the drawing), Ridley used the name *Gastrochilus minor* Bak., and repeated this also in his Materials (vol. 2, p. 17). When preparing his Flora however he realized that Baker's species was different and published a new name, *G. flavus*, for the Batang Padang plant. The specimens are such that it is impossible to see the inflorescence-structure clearly without destroying them; I think however that I am correct in stating that this is similar to the structure of *B. pandurata*. The flower of *B. flava* is large, and its yellow colour with red markings distinctive.

SPECIMENS. *Perak.* Batang Padang, cult. Penang, Curtis (type). Bukit Kepayang, Ridley s.n. February 1904. Bujong Malacca, Ridl. s.n. September 1898.

6. **Boesenbergia longipes** (King & Prain) Schltr., Fed. Rep. 12: 316. 1913. *Gastrochilus longipes* K. & P. ex Ridl., J.S.B.R.A.S. 32: 113. 1899. Flora 4: 250.

Rhizome underground; intervals between leaf-shoots about 4–5 cm. or longer; roots bearing tubers. *Leaf-shoots* bearing 2 or 3 leaves and several sheaths; longest sheath about 12 cm. long, reddish. *Leaf-blade* to about 30 by 10 cm., widest above the middle, apex broadly pointed, base gradually narrowed, midrib slightly hairy beneath, upper surface dark green; petiole to 18 cm. long; ligule-lobes 1·5–2 cm. long; *sheath* to 12 cm. long, more or less flushed with red. *Inflorescence* enclosed by leaf-sheaths as in *B. pandurata;* flowers not

fragrant. *Bracts* 3–4 cm. long. *Calyx* with ovary about 1·7 cm. long. *Corolla-tube* about 4·5 cm. long; dorsal lobe about 1·5 cm. long and 7 mm. wide, elliptic, acute, laterals a little narrower, all white. *Staminodes* about 1 cm. long and 7 mm. wide, white with very pale yellowish tips and a small reddish mark at the base. *Lip* about 2 cm. long, obovate, the basal part slightly concave, the apical part with thin crinkled reflexed edges, not lobed, white, with a yellow median band widening towards the apex, and on either side of it in the basal 2/3 an irregular band of crimson. *Stamen* white; filament about 4 mm., anther 4 mm. long; pollen-sacs dehiscing by slits; anther-crest small, fleshy, not wider than rest of anther, rounded, slightly retuse.

This species was based on a single collection made by Wray at Briah, Larut, without colour notes. The specimen in the Singapore herbarium (presumably that seen by Ridley when he described the species) has only a single partly broken dried flower, lacking the corolla-tube and calyx. I have examined this flower, soaked in water, and find the following dimensions of parts: corolla-lobes about 1 cm. long; staminodes about 6 mm. long; lip little over 1 cm. long; filament 2·5 mm., anther 2·5 mm. long, with small rounded crest (certainly not 2-lobed with acute lobes as in *B. pandurata*). Ridley's statement that the staminodes are longer than the lip is certainly wrong. His further statement that the inflorescence resembles that of *G. lancifolius* is also incorrect.

In 1936 Corner collected at Kuala Kangsar a specimen (including a flower in alcohol) which agrees exactly in leaf and inflorescence with Wray's type of *B. longipes*. The flower, including anther, has a similar shape (so far as one can judge from the incomplete dried specimen) but is about 50 per cent larger. In view of the uncertainty of exact dimensions of Wray's flower, I give above measurements taken from Corner's specimen. Further collections are needed to show whether one or two species exist. The specimens are: Briah, Larut, Wray 4220. Kuala Kangsar, in forest by stream, S.F.N. 31673 (Corner).

7. **Boesenbergia pandurata** (Roxb.) Schltr., Fed. Rep. 12: 316. 1913. *Kaempferia pandurata* Roxb., Asiat. Res. 11: 328, t. 2. 1810. Fl. Ind. 1: 18. 1820. Bot. Reg. t. 173. 1816. *Gastrochilus panduratus* Ridl., J.S.B.R.A.S. 32: 114. 1899. Flora 4: 249. Valet., Bull. Btzg. 2nd Ser. XXVII: 91.

Leafy shoots short, each with 3 or 4 leaves, with bladeless red sheaths at the base. *Leaf-blades* to about 28 by 10 cm. (the outer shorter ones often wider than the inner longer ones), slightly asymmetric, elliptic, shortly pointed, base cuneate, the midrib at least slightly hairy beneath; *petioles* 5–12 cm. long, slightly winged, channelled; ligule-lobes broadly triangular, about 5 mm. long; sheaths with thin edge decurrent

from the ligule, the longest sheath about 12–15 cm. long. *Inflorescence* completely enclosed by the leaf-sheaths except the extreme tips of the bracts, constructed as in *B. plicata* but with very short rachis and crowded bracts. *Bracts* about 4·2 cm. long, green, about 4 mm. wide. *Bracteoles* about as long as bracts and about as wide. *Calyx* with ovary about 1·8 cm. long. *Corolla-tube* about 1·5 cm. longer than bracts; lobes 1·5 cm. long, pink. *Staminodes* a little shorter and broader than corolla-lobes, pink. *Lip* about 2·5 cm. long, not deeply saccate, apex reflexed and slightly bilobed, coloured a deeper pink than the petals and staminodes, (pale towards edges and base ?). *Stamen* in all about 1 cm. long. *Anther* about 5 mm., with short narrow reflexed bilobed crest.

This species was originally described by Roxburgh from a cultivated plant brought to Calcutta from Sumatra. It is probably native in both Java and Sumatra and widely cultivated in Malaysia and India for its rhizome, which is used as a flavouring for food and as medicine. The Malay name is *Temu Kunchi*. The only Malayan specimens in the Singapore herbarium which seem referable to *B. pandurata* are from Penang, above the Waterfall, where perhaps they may have been a relic of former cultivation, and a doubtful one from Sungei Siput in Perak. Roxburgh's description of the structure of the inflorescence is very complete and there is no doubt of the status of the species. The dimensions given above are taken from dried Penang specimens and the parts of the flower may perhaps be somewhat larger.

SPECIMENS. *Penang.* Top of waterfall, near the Bungalow, 750 feet, Fox s.n. 25 July 1899. Waterfall Valley, S.F.N. 1180 (Burkill). *Perak.* Sungei Siput, S.F.N. 6984 (Haniff and Nur); anther-crest not distinct, but habit of plant and size of flowers agree with *B. pandurata.*

8. **Boesenbergia clivalis** (Ridl.) Schltr., Fed. Rep. 12: 316. 1913. *Gastrochilus clivalis* Ridl., J.S.B.R.A.S. 32: 114. 1899. Flora 4: 249. *G. puberulus* Ridl., J.S.B.R.A.S. 57: 102. 1910. Flora 4: 251.

The type of this species differs from *B. pandurata* in smaller size of inflorescence and flowers as follows: *Bracts* about 3·5 cm. long. *Calyx* with ovary about 1·7 cm. long (dried). *Corolla-tube* 4·2 cm. long, lobes little over 1 cm. long. *Staminodes* slightly shorter than corolla-lobes. *Lip* apparently about 1·5 cm. long.

The type is Ridley s.n. 1897, from 15th mile Pahang Track, Selangor. No colours of the parts of the flower are recorded. Ridley's statement that each bract contains 4 or 5 flowers is incorrect; the arrangement of bracts and bracteoles is typical of Boesenbergia. The shape of the anther-crest of the single flower agrees with *B. pandurata.*

Recent collections from near Labis in Johore (S.F.N. 38265, Henderson) are plants of larger size than the type

of *B. clivalis* but agree in essentials. Details are as follows:

> *Leaves* on each shoot about 6; largest leaf-blade to 52 by 13·5 cm., medium green, pale beneath, main veins raised on upper surface; petiole to 20 cm. long; sheath 9 cm. long, very broad, slightly purplish, ligule-lobes rather narrowly triangular, to 2·5 cm. long. *Inflorescence* enclosed by sheaths of uppermost two leaves. *Bracts* pale green or the outer ones flushed with purple, 4·5–5 cm. long, 15 mm. wide. *Bracteoles* nearly as long as bracts and a little narrower, thin and translucent. *Calyx* 18 mm. long. *Corolla-tube* nearly 6 cm. long, dorsal lobe 20 mm. long and 10 mm. wide, white. *Staminodes* white. *Lip* a little longer than corolla-lobes, with translucent purple veins laterally and central yellow patch. *Anther* 7 mm. long (excluding crest), filament 4 mm.; crest reflexed, 2 mm. long, bilobed, almost 4-lobed, the outer lobules narrow and acute. *Fruit* 27 mm. long, 8 mm. wide, containing several seeds; calyx persistent at fruiting.

Ridley's *Gastrochilus puberulus* (type from Temango, Perak, no. 14423) is similar vegetatively except that it has narrower leaves (to 30 by 6 cm.), and the flowers agree in essential structure; Ridley states that the lip is yellow with a red line on each side of the central ridge.

Accepting the Labis and Temango specimens as *B. clivalis*, the chief distinction from *B. pandurata* would seem to be the yellow colour of the lip. Further information about both species is needed.

Other specimens are: *Pahang.* Kuala Teku, Seimund 398. *Selangor.* Ulu Gombak, 10th mile, 1,000 feet, Md Nur s.n., 24.10.1937.

Another collection from Johore (S.F.N. 10296, Holttum, from north of G. Blumut), has similar flowers of similar colour, but only one broader leaf on each shoot; it is probably a distinct species.

7. KAEMPFERIA LINNAEUS

Rhizome fleshy, usually of short elements each bearing one to a few leaves with a terminal inflorescence, or in a few cases leaves and flowers on separate shoots, not simultaneous. *Roots* often bearing small tubers. *Erect stems* usually short. *Leaf-blade* usually broad, sometimes variegated or purple beneath; *petiole* short; *sheath* often short; *ligule* usually small. *Inflorescence* usually enclosed by the imbricating leaf-sheaths, or by blade-less sheaths when it appears on non-leafy shoots; in *K. elegans* the peduncle elongates so that the whole inflorescence is free from the sheaths. *Flowers* few to many, spirally arranged, usually on a flat or convex receptacle, each solitary in the axil of a bract and accompanied by a small thin bidentate or bifid bracteole. *Bracts* much longer than wide, their bases encircling a large part of the axis, their edges involute,

closely imbricating. *Calyx* tubular, split for a short distance and unequally toothed, usually much shorter than the corolla-tube (as long in *K. rotunda*). *Corolla*-tube long; lobes subequal, relatively long and narrow, spreading or reflexed. *Staminodes* petaloid, flat, spreading, basal part often narrow, widened abruptly to an elliptic, oblong or nearly round blade, often similar to the halves of the lip, usually white or lilac. *Lip* nearly flat, often wider than long, base sometimes narrow, blade deeply bilobed, the two halves often of similar shape and size to the staminodes, usually white or lilac, sometimes marked with a different colour towards the base. *Stamen*: *filament* none or very short; *anther* hardly exserted beyond the throat of the flower; *pollen-sacs* parallel, dehiscing longitudinally, not produced into free tips at the base; *crest* of connective usually large, entire or lobed, usually reflexed and filling the throat of the flower. *Ovary* trilocular (or apparently in some species unilocular) with few to numerous seeds; *fruit* usually thin-walled, dehiscent (always?); *seeds* ellipsoid to nearly round with lacerate aril.

The genus Kaempferia dates from Linnaeus, who included *K. rotunda* and *K. galanga* in the first edition of his *Species Plantarum*. But though these species, and a few others, have been several times described and illustrated, and have been cultivated so that botanists could examine them in the living state, the first description of the inflorescence was given by Valeton in 1918. Valeton was in fact the first botanist to write a satisfactory generic diagnosis; the above statement is taken from his work.

Kaempferia, Scaphochlamys and Boesenbergia are all nearly related. Boesenbergia seems distinct enough in its peculiar inflorescence and in the lip being entire, often very concave and often red towards the apex; but the line of distinction between Scaphochlamys and Kaempferia is much less easy to draw. Valeton only saw good and complete material of two species of Scaphochlamys (*Gastrochilus laxiflorum* Valet., *Scaphochlamys Kunstleri* (Bak.) Holtt.); he included both in Gastrochilus, though recognizing them as aberrant. But the present collection of specimens from Malaya extend the range of our knowledge of Scaphochlamys very greatly; they indicate clearly its distinction from Gastrochilus Wall. and also its closer approach to Kaempferia. On the other hand, Kaempferia, as represented by species of close alliance to Linnaeus's two, is only found in the extreme north of Malaya, and our collections are small. I have seen cultivated plants of three of our species, but take some information from Valeton, whose work fortunately supplies many of the deficiencies of mine.

Kaempferia has a short compact inflorescence, one flower to each bract, the flower accompanied by a more or less deeply 2-lobed bracteole or by two narrow separate bracteoles; the lip is deeply bilobed, the staminodes rather broad and spreading, the filament very short, and the anther-crest usually large. Scaphochlamys has a compact to very elongated inflorescence with several flowers to each bract (*except* in *S. biloba*), the bracteoles sometimes 2-nerved but never (to my knowledge) bilobed. Scaphochlamys has almost always relatively narrower staminodes and lip than in Kaempferia, the lip never so deeply bilobed, and the filament always present (though never long), the pollen-sacs always free at the base (not free in Kaempferia?). The aberrant species *S. biloba* has a long narrow entire bracteole very unlike the bracteoles of Kaempferia. If we take the distinction of one flower to one bract as against several flowers to one bract, it breaks down at *S. biloba*; but here the bracteole-character and general flower-shape puts *S. biloba* into Scaphochlamys. The flower-colour also, with the invariable yellow median band of the lip, is not found (or not constant) in Kaempferia.

The habit of Kaempferia, with rhizome of short fleshy elements and fleshy tuber-bearing roots is also different from the less fleshy, often long-creeping rhizome of Scaphochlamys with rather wiry roots which sometimes develop into stilts and support the rhizome above ground level. Kaempferia species also are usually adapted to a seasonal climate, resting leafless in the dry season; Scaphochlamys are evergreen, native in shady forests in a country with no prolonged drought. The genus Kaempferia is widely distributed in Africa and Asia, and the species also are in many cases of wide distribution.

An interesting feature is the presence in all three genera of some species with unilocular ovaries, but apparently not in all species of any one genus, as here constituted. Schumann was so impressed by the importance of this character that he made a special genus Haplochorema founded especially upon it. His *H. uniflorum*, considered by Valeton to be identical with *Kaempferia decus-sylvae* Hall., is described in detail by Valeton and judged by every other character * it is a species of Kaempferia. *Haplochorema sumatranum* Burk. is equally clearly a Boesenbergia. *Scaphochlamys tenuis* and *S. erecta* have also unilocular ovaries, with one and three ovules respectively. *S. Kunstleri* is reported by Valeton to have sometimes unilocular and sometimes trilocular ovaries. The character is thus

* Except that the flowers are said to develop from apex to base of the inflorescence as in Boesenbergia.

an unstable one, and cannot reasonably be used as the basis for a genus. Schumann's species probably all belong to Boesenbergia or Kaempferia but his descriptions of the inflorescence leave their individual status in doubt.

If we assume here, as throughout the rest of the family Zingiberaceae, that the primitive inflorescence is one with a cincinnus of several flowers in the axil of each bract, then Scaphochlamys has the most primitive inflorescence of the three genera. That is not to say that the other two genera have been derived directly from Scaphochlamys; but Scaphochlamys has preserved that particular primitive form. It also has a much more restricted distribution than Kaempferia, and at the same time has produced a relatively large number of species, most of them apparently local, in the forests of Malaya. Kaempferia, in adapting itself to life in more open places and in seasonal climates, extended greatly the possible range of its distribution, and has travelled right across Africa, being the only genus of this branch of the family Zingiberaceae which has done so. There can be little doubt that the headquarters of this branch is in Asia, and probably in Burma, where all the genera (except perhaps Scaphochlamys) are now represented.

KEY TO THE MALAYAN SPECIES OF KAEMPFERIA

Flowers and leaves borne on separate branches of the rhizome, not simultaneous; staminodes erect, about 5 cm. long — 1. *K. rotunda.*

Flowers produced at apex of leaf-bearing stem, the inflorescence sometimes entirely enclosed by the innermost leaf-sheaths; staminodes much smaller

- Flowers white, with purple on lip only — 2. *K. galanga.*
- Flowers lilac, white at base of lip only
  - Petiole and sheath to about 6 cm. long; leaf-blade horizontal; scape enclosed by leaf-sheaths; anther-crest narrow, spathulate — 3. *K. pulchra.*
  - Petiole and sheath longer; leaf-blade more or less erect; scape exserted beyond leaf-sheaths; anther-crest as wide as long, or nearly so — 4. *K. elegans.*

1. **Kaempferia rotunda** Linn., Sp. Pl. ed. 1, 3. 1753. Ridl., Flora 4: 246. Valeton, Bull. Buitenz. 2nd Ser. XXVII: 109. Bot. Mag. t. 6054. **Fig. 14.**

Rhizome consisting of subglobose tubercles; roots bearing tubers. *Leaves* 2, erect, stalked; blade to about 45 by 11 cm. (commonly smaller), purple beneath and usually variegated on the upper surface. *Inflorescence* appearing from the leafless rhizome, sessile or shortly stalked, surrounded by a few sheaths,

the outer ones purple-tinged, the longest to 8 cm. long. *Flowers* about 10, borne on the almost flat apex of the axis of the inflorescence. *Flowering* bracts diminishing in size towards centre of inflorescence, the largest to 3·5 cm. long; bracteoles binerved and bidentate, to 2·3 cm. long. *Calyx* 3–6 cm. long, faintly greenish, split down one side, apex shortly 3-toothed. *Corolla-tube* as long as calyx; lobes very narrow, as long as the tube, white. *Staminodes* erect, oblong with rounded or acute apex, about 5 cm. long, white. *Labellum* lilac (paler towards edges, and with white veins in basal part), about as long as the staminodes, deeply bilobed, the lobes curved downwards. *Anther-crest* longer than rest of anther, relatively narrow, 2- to 4-lobed, the outer lobes narrow and elongate.

This species is widely cultivated in south eastern Asia, and is used medicinally. It is said also to be used as a flavouring for food. Its country of origin is not certainly known; possibly Indo-China. Valeton reports that it is apparently wild in East Java, but he considers that it may have escaped from cultivation. It is not mentioned by Rumphius in the Herbarium Amboinense (late 17th century). In Malaya it is perhaps not uncommon in the north, but can only be kept alive in cultivation in the south. In Singapore the plants rest after the leaves die, and then need some protection from rain.

2. **Kaempferia galanga** Linn. Spec. Pl. Ed. 1.2.1753. Bot. Mag. t. 805. Ridl. Flora 4: 245. Valet. Bull. Buitenz. 2nd Ser. XXVII: 108. K. Schum. Pflanzenr. Zingib. 77.

Leaves 2 or 3, almost horizontal and near the ground, to about 15 by 10 cm., apex rather broadly pointed, green with (often at least) a narrow reddish edge, much paler beneath; petiole and sheath about 3 cm. long, broadly channelled. *Inflorescence* sessile, enclosed by the imbricating leaf-sheaths, constructed as in *K. pulchra*, without any sterile involucral bracts; flowers 12 or more. *Bracts* about 4 by 1 cm. (outer ones) down to 2·5 cm. long near the centre. *Bracteoles* two to each flower, narrow, facing the bract, to about 3·5 cm. long. *Calyx* about 3 cm. long. *Corolla-tube* 4·5–5 cm. long; lobes 2·5 cm. long, white, narrow, spreading. *Staminodes* spreading, obovate, about 2·2 by 1·4 cm., white. *Lip* about 2·3 cm. long and 2·5 cm. wide, divided 2/3 to the base, the lobes entire or somewhat lobed, the whole lip white with two longitudinal violet bands in the basal half. *Anther* white, sessile with a white bilobed reflexed crest, the lobes rounded.

This species is said to be native in India. It is widely cultivated throughout south-eastern Asia and used both to flavour food and medicinally. The Malay name *Chĕkur* is well known. It seems to be a common village plant in Malaya, at least in the north, and the rhizomes are sold in all parts of the country. Like *K. pulchra*, it does not maintain itself in Singapore, except in cultivation. It flowers occasionally in Singapore; I have induced flowering by drying a plant for a few weeks.

3. **Kaempferia pulchra** Ridl., J.S.B.R.A.S. 32: 107. 1899. Flora 4: 245. Valet., Bull. Buitenz. 2nd Ser. XXVII: 113. **Fig. 15.**

Leaves 2 or 3; blade horizontal, close to the ground, commonly about 8–14 cm. long and 4·5–8 cm. wide, asymmetric, elliptic, broadly pointed, base rounded, dark green above, variegated with pale grey-green; petiole and sheath broad, 3–6 cm. long, more or less hairy; petiole to 1 cm. long; ligule-lobes rounded, small; sheaths closely imbricating and enclosing the inflorescence. *Scape* quite enclosed by the leaf-sheaths, sometimes nearly as long as the sheaths. *Inflorescence* bearing 10 or more flowers on a somewhat convex (not elongated) receptacle, each flower protected by a bract and bracteole, the outer bracts longest, all fertile. *Bracts* pale green, narrow, 2·5–3·5 cm. long, closely imbricate, thin, outermost spotted with purple. *Bracteoles* about 1 cm. long, bifid to the base, the segments very narrow. *Corolla-tube* about 4 cm. long; lobes about 1·2 cm. long and 3 mm. wide, white, rolled backwards and inconspicuous. *Staminodes* lilac; basal claw narrow, 6 mm. long, blade rounded, a little longer than wide, about 1·9 cm. long. *Lip* coloured as the staminodes except for a small white and yellow area at the base, bilobed to the base of the blade, the halves of the blade a little longer and narrower than the staminodes, spreading in the same plane as the staminodes and forming a quadrate flower, the basal 7 mm. narrow with inflexed sides, almost forming a tube and completely embracing the stamen except for the broad apex of the crest. *Anther* 3 mm. long, sessile, hidden in the throat of the flower, shorter than the spathulate crest (7 mm. long) which has a long narrow basal part, its obovate tip showing in the mouth of the flower, the apical part lilac, rest white. *Stylodes* very slender, c. 6 mm. long. *Stigma* with long hairs on the front margin. *Fruit* 1·2 cm. long, oblong or ovoid, smooth, with a thin wall, 3-locular, each loculus commonly with 4 seeds. *Seeds* globose, irregularly compressed, 3 mm. long, the aril with many segments, some longer than the seed.

This species occurs on limestone in Langkawi and Lower Siam. It is cultivated in the Waterfall Gardens, Penang, where it maintains itself in sandy ground in shade-rockeries, but does not flourish so well nor flower so regularly or freely in Singapore. In a strongly seasonal climate the leaves die in the dry season. The flowers appear with the new leaves after rains begin, and are produced throughout the rainy season. In Singapore the plants are almost evergreen. The fullest account of the species (especially of the inflorescence) is that of Valeton, from which data on bracts and fruits are taken. Gagnepain says the staminodes are 2·5 cm. long and 2 cm. wide, but I have not seen any so large. The size of the leaves varies much; I have seen none as large as the 7 by 5 inches given by Ridley. The species is very attractive and floriferous under suitable conditions, and well worth cultivating for ornamental purposes. In Singapore, under moist shady conditions, the leaves are larger, on longer petioles and more erect

than in more open conditions in sandy ground at Penang.

The basal parts of the corolla-lobes, staminodes and lip are all parallel to the axis of the flower and (without being joined together) form a tube c. 6 mm. long which completely encloses the stamen. The staminodes and lip are bent abruptly at right angles at the apex of this tube and form a nearly flat flower.

4. **Kaempferia elegans** (Wall.) Bak., F.B.I. 6: 222. 1890. Ridl., Flora 4: 245. *Monolophon elegans* Wall., Pl. Asiat. Rar. 1: 24, t. 27. 1830.

Leaves 1 or 2, erect or suberect; blade green, sometimes with greyish spots, 12–15 cm. long, to about 7 cm. wide, asymmetric, elliptic, broadly pointed; *petiole* and *sheath* 8–12 cm. long, the petiole about 1·5 cm.; *ligule*-lobes small, rounded. *Inflorescence* shortly exserted from the sheath on a slender peduncle to about 4 cm. long beyond the top of the leaf-sheath; whole inflorescence about 4 cm. long and about 7 mm. wide, the two outer bracts sterile, pale green more or less spotted with purple; inner bracts shorter. *Calyx* shorter than bracts. *Corolla-tube* about 5 cm. long; lobes about 1·5 cm. long, narrow. *Staminodes* lilac, obovate, about 1·8 cm. long. *Labellum* as long as staminodes and similarly coloured (apparently not white at the base), bilobed nearly to the base, *anther* sessile; crest broad, entire, reflexed, rounded, hardly longer than wide. *Distribution:* Tenasserim; said to occur in Langkawi and Kedah.

This species and *K. pulchra* Ridl. are very nearly allied. According to Wallich's drawing, *K. elegans* has larger plain green leaves on longer stalks, peduncle of inflorescence much longer than leaf-sheath and a short broad anther-crest. As regards size of leaves and length of petiole, *K. pulchra* varies much. Specimens from Langkawi and Kedah certainly agree vegetatively more nearly with *K. elegans* as illustrated by Wallich than with most specimens of *K. pulchra*. I cannot see the anther-crest distinctly in any of them; their flowers are exactly like *K. pulchra* in shape and size of other parts.

I think it very probable that all specimens referred by Ridley to *K. elegans* are really only unusually large plants of *K. pulchra*; and it is even possible that the supposed distinction of the anther-crest is due to an error by Wallich's artist. If it should prove that the two species are identical, Wallich's name naturally should stand.

8. **HANIFFIA** Holttum, gen. nov.

Rhizoma repens, caules 1- vel pluri-foliatos ferens; *inflorescentia* basi caulis foliati enata, pedunculus tenuis brevis vaginis biseriatis vestitus, rachis brevis pauciflora, bracteae involucrantes nullae; *bracteae primariae* tenues flores singulos amplectentes; *bracteolae* nullae; *calyx* longus,

tubulosus; *corollae* lobi inaequales; *staminodia* lobis lateralibus corollae fere aequalia; *ovarium* basi solum triloculare, ovula pauca.

Species typica: *Elettariopsis cyanescens* Ridley.

This genus is probably most nearly allied to Roscoea, differing in the separate inflorescence and leaf-shoot and in the lack of basal appendages to the anther. Apart from its separate inflorescence and leaf-shoot, it appears to differ from *Kaempferia secunda* in lacking bracteoles, in its narrower staminodes and lip and in its longer stamen with very short crest. From typical species of Kaempferia it differs in the leafy stem, which in *H. cyanescens* resembles exactly that of a small Zingiber, in the elongate relatively slender rachis of the inflorescence, lack of bracteoles, narrow staminodes, lip not deeply bilobed, and length of anther-filament.

Two species are known. The second species is undescribed, and is represented by a single specimen in Herb. Singapore, collected at Bacho in Peninsular Siam, lat. 6° 26' (S.F.N. 24293, Kiah). The leaf-shoots have each a single leaf (blade c. 12 by 3 cm., petiole and sheath c. 6 cm.); the inflorescence is exactly as in *H. cyanescens*; the flowers are smaller, with corolla-lobes 1·5 cm. long, the other parts not well enough preserved to be accurately described but in general having the same shape and proportions as in *H. cyanescens*.

The genus is named to commemorate the late Mohamed Haniff, who was a member of the staff of the Botanic Gardens of the Straits Settlements (chiefly in Penang) for thirty years. Mr. Haniff had a considerable knowledge of Malayan plants and his collections added greatly to the value of the Singapore herbarium. His field notes and small flower-sketches of Zingiberaceae and Orchids have in many cases provided useful information not otherwise available; he collected one of the three known specimens of *Haniffia cyanescens*.

Haniffia cyanescens (Ridl.) Holtt., **comb. nov.** *Elettariopsis cyanescens* Ridl., J.S.B.R.A.S. 41: 31. 1904. *Kaempferia cyanescens* Ridl., J.S.B.R.A.S 86: 308. 1922. Flora 4: 246.

Leaf-shoots to 5 cm. or more apart, 45–80 cm. tall, bearing 4–7 pairs of leaves on the upper half. *Leaves* to about 18 by 3 cm., narrowly elliptic, acuminate, base narrowly cuneate, glabrous; petiole lacking; ligule about 3 mm. long, broad, hardly lobed, rather sparsely hairy; base of midrib and parts of sheath near ligule also more or less hairy. *Inflorescence* arising from the base of the leaf-shoot; peduncle 1–2·5 cm. long, covered with alternate thin ovate sheaths the upper

ones longest, to 2 cm. long; rachis hairy, 1 cm. long or rather more. *Flowers* about 5, each in the axil of a bract, without bracteoles. *Bracts* thin, to about 2·2 cm. long and 1·0 cm. wide, elliptic, bluntly pointed. *Ovary* about 4 mm. long, hairy. *Calyx* with ovary 2·7 cm. long, hairy. *Corolla-tube* about 4 cm. long, hairy; lobes white, about 2 cm. long, the dorsal 8 mm. wide near the base, laterals 5 mm. wide, all more or less hairy on the back. *Staminodes* about 2·5 cm. long and 0·6 cm. wide, white. *Lip* about 2–3 cm. long, obovate, apparently about 1·5 cm. wide, bilobed (not very deeply ?), the lobes rounded "violet veined with white" (Ridley). *Filament* 3 mm. long; anther 6 mm. long, pollen-sacs narrow and parallel, without extended free base; connective prolonged at the apex to a small crest (apparently 3-lobed) about 1 mm. long, not wider than rest of anther. *Stylodes* slender, 4·5 mm. long, joined together except for short free tips.

This species has been found twice at Bukit Tangga in Negri Sembilan, once near G. Bintang on the Kedah-Perak boundary, and once in Peninsular Siam. No material preserved in alcohol is available, and the above dimensions may not all be accurate; they are made from rather fragmentary dried flowers soaked in water.

SPECIMENS. *Negri Sembilan.* Bukit Tangga, W.G. Napier s.n. 1903 (Type); Ridley s.n. December 1920. *Kedah.* B. Kuala Bintang, G. Bintang, S.F.N. 21086 (Haniff). *Siam.* Bukit, lat. 6° 11′, S.F.N. 24254 (Kiah).

TRIBE ALPINIEAE

This division of the family and the genus Costus together include almost all the larger species (vegetatively considered). Some are very large, and the proportion with leaf-shoots less than one metre tall is very small. The only genus which has always short leafy stems, the leaves longer than the stems and few in number, is Elettariopsis; this is vegetatively much like many members of the Hedychium tribe.

There is thus less vegetative diversity in the Alpinia tribe than in the Hedychium tribe, but probably more diversity in the inflorescence. Assuming as we have done (p. 7) that the primitive inflorescence in the family is terminal on a leafy stem, and has a cincinnus of several flowers in the axil of each bract, Alpinia represents a primitive condition, and it is possible to derive the other forms of inflorescence from it by various changes. Alpinia (in the sense here used) also has tubular or cup-shaped secondary bracts, and these may perhaps also represent another primitive character, which is preserved in many genera of this tribe though not in the Hedychium tribe.

A character in which Alpinia and its immediate allies have probably departed from the primitive condition is in having quite small primary bracts or none at all. This

reduction is explained when we see how the whole inflorescence is entirely enclosed by two large sheaths (representing the leaves next below the inflorescence) up to a very late stage of development; owing to the protection given by these sheaths, large primary bracts are unnecessary.

In constrast to the Hedychium tribe, a number of genera in the Alpinia tribe have the inflorescence borne on a non-leafy shoot in all species, and the degree of specialization is in some cases considerable.

The following are the principal modifications from the Alpinia type of inflorescence found in this tribe.

(1) *Specialization of the flowering shoot.* In this, the 2-ranked leaves which would develop blades on a leaf-shoot are reduced to (relatively small) sheaths only, but in many cases the rudiment of a blade is seen in a subapical point. These sheaths usually increase gradually in size from base to apex of the scape, the upper ones being often large and embracing the base of the inflorescence, like the upper sheaths in Alpinia.

(2) *Reduction or increase in size of primary bracts.* In Plagiostachys and Catimbium the primary bracts appear to have disappeared entirely. In Alpinia, Languas and Geostachys they are often very small, and sometimes also in Cenolophon. In Amomum, on the other hand, they are large, sometimes very large.

(3) *Development of an involucre of sterile bracts.* This has occurred in Phaeomeria, Achasma and Hornstedtia. The uppermost of the two-ranked sheaths take some part here also in protecting the base of the inflorescence, but the main protection is by large spirally arranged bracts which must be regarded as sterilized primary bracts of the inflorescence. These are often gradually smaller inwards and there is usually no sharp transition between them and the fertile primary bracts. Most of the primary bracts however are much smaller, their protective function being now largely dispensed with.

(4) *Reduction of number of flowers in the cincinni.* In many genera each cincinnus is reduced to one flower only. The exceptions are: Alpinia, Geostachys, Elettaria, Languas, all of which usually have a number of flowers in each cincinnus. In Catimbium there are almost always at least two flowers in a cincinnus towards the base of the inflorescence. In the other genera, one flower is the rule; the only known normal exceptions are *Hornstedtia leonurus*

and *Elettariopsis triloba*, but Valeton reports that sometimes the bracts of Phaeomeria have two flowers.

In the case of a cincinnus of several flowers, the first one to open is truly terminal, and is not in the axil of a bract. The bract which actually surrounds it in Alpinia (where the flowering bracts are cup-shaped) has the second flower in its axil. Thus where the flowers in a cincinnus are reduced to one, the bracteole is really the bract of the lacking second flower. That flower is often present as a rudiment in Catimbium, but is apparently quite suppressed in Amomum. In the same way, the third flower appears to be suppressed in *Hornstedtia leonurus*, though its bract surrounds the second flower.

(5) *Modification of secondary bracts.* In most cases the secondary bracts (or bracteoles) retain their tubular character, the exceptions being: Hornstedtia (except *H. leonurus*), a few species of Amomum, Elettariopsis, Languas, Catimbium, Cenolophon. In Cenolophon the secondary bracts have quite disappeared; in Catimbium they are large and of peculiar shape, split to the base, and deciduous.

Where the cincinnus is not reduced to a single flower, and the flowering bracts are not cup-shaped, the cincinnus-structure is clear, and the first flower is seen to be terminal, not axillary. If a cincinnus with such bracts is reduced to one flower, the flowering bracts should logically all disappear (as in Cenolophon); but in Catimbium (the upper flowers of which are solitary) the single flowers are covered with large bracteoles. The second flower here is usually not entirely suppressed, but present as a rudiment, and this also occurs in the case of the inner solitary flowers of *Elettariopsis triloba*. In the case of paired flowers of *E. triloba*, the first has clearly no bracteole; the second has one, which encloses it only. This is an interesting contrast to the case of *Hornstedtia leonurus*.

(6) *Shortening of the rachis.* This has occurred in Phaeomeria, Achasma and Hornstedtia, and to a smaller degree in Amomum and Plagiostachys. In the three former genera, the inflorescence has become densely crowded, and the axis is short. In some cases (Achasma, most Hornstedtia and some Phaeomeria) the axis is almost flat; in other cases it is short and densely covered with flowers.

(7) *Shortening of the scape.* In Hornstedtia, Achasma, and some species of Amomum, the scape is very short; so much so that the inflorescence is only just at ground level, its base often buried in the ground. In a few species, only the upper part of each flower is above ground

level. The fruit then ripens underground. This condition is found also in some species of Elettaria, but not due to shortening of the scape. The tubes of such flowers are usually very long.

(8) *Decurved or prostrate inflorescences.* These are found in Geostachys, Elettaria and Elettariopsis. In Geostachys some species have erect and some decurved inflorescences. In Elettaria and Elettariopsis the inflorescence is prostrate, or nearly so, sometimes quite subterranean. In *Elettaria longituba* the scape and rachis of the inflorescence are horizontal and below ground level. There appears to be no sharp distinction between scape and rachis, the two-ranked sheaths being similar throughout, all except the basal ones having axillary cincinni which curve upwards, the base of their flower-tubes being below ground level.

(9) *Plagiostachys.* This quite peculiar genus has a branched inflorescence which is terminal on the erect stem but pushes its way through the side of the combined leaf-sheaths instead of growing straight up and emerging at their apex as in Alpinia.

Flowers. The flowers in this tribe are more uniform than in the Hedychium tribe, except for the Hornstedtia group of genera, where they are modified to suit the condition of very compact inflorescences with long bracts, and also are predominantly red in colour. Geocharis also shows peculiarities, resembling to some extent the Papuasian genus Riedelia not known in Malaya. Apart from these, the flowers are fairly uniform in shape, though with a fair variety in colouring. A good number of species of Amomum, Elettariopsis and Plagiostachys have a white lip with yellow median band bordered by red stripes, very similar to the colour arrangement so common in Scaphochlamys. But in these genera of the Alpinia tribe the lip is not deeply bilobed; it is usually rather distinctly trilobed, the middle lobe being due presumably to the development of the rudiment of the outer staminode.

Definition of genera. The genera are in most cases clearly distinguishable on inflorescence-characters. As in the Hedychium tribe, it is difficult to base distinction on flower-character and especially on characters of the anther-crest.

The genera as at present limited are in most cases easy to recognize, but there are some species which owing to specialization do not have the typical aspect of their genus. This is especially the case with the reduced species of Achasma with inflorescences quite buried in the ground. The presence of an involucre of sterile bracts is here not

obvious; but in this case the flowers are of very characteristic shape. Elettariopsis and Amomum are also not easy to discriminate, and I am not altogether satisfied with the present arrangement. The details are fully discussed under the genera concerned.

The status of the generic name Alpinia. This name was used by Linnaeus for the tropical American species *Alpinia racemosa*; he described no other. Later the younger Linnaeus described *Renealmia exaltata*, also from tropical America. Asiatic species were subsequently referred to both genera, up to the monograph of Horaninow of 1861; but authors did not agree as to the distinctions between the two genera. Later authors, including Schumann, considered the type species of Alpinia and Renealmia to belong to one genus, but as meanwhile the name Alpinia had been mainly used for Asiatic species, the name Renealmia was adopted for those in tropical America (and West Africa), and Alpinia was used for an assemblage of species which did not include the type species *A. racemosa*.

This was obviously an unsatisfactory state of affairs. American botanists wished to regularize the use of the name Renealmia, and so its conservation was proposed; this involved the rejection of Alpinia Linn. The species of Alpinia in Schumann's sense then needed a new name. It was proposed that the next oldest generic name for any of them should be used, namely Languas Koenig; and accordingly many species of Alpinia were transferred to Languas. Later, the committee appointed at Amsterdam to consider further proposals for conservation of generic names proposed that a new status should be given to the name Alpinia, namely that it should be called Alpinia Roxb. (non Linn.), and should be typified by the species *A. galanga* (L.) Sw., which is also the type of Languas Koenig. Assuming a continuance of the generic concept of Schumann, this proposal would avoid further name-changes.

But Schumann's Alpinia is an unsatisfactory mixture, concerning which Ridley expressed the opinion fifty years ago that it ought to be subdivided. It would have been far better to have studied the problem of this subdivision before proposing another type species for Alpinia. As a result of my study of the species concerned in Malaya, it seems to me that they fall clearly into four groups, which are as distinct as most genera in the family. For two groups the names Catimbium and Cenolophon are available; a third group includes *A. galanga*; the fourth group is Schumann's section Dieramalpinia. This fourth group includes many species not represented in Malaya, and some among them have received other generic names. Without studying

these, I do not know what generic name should be used, in right of priority, for my fourth group, if the name Alpinia is used for that containing *A. galanga*. I am therefore continuing to use the name Alpinia for this fourth group of species, retaining Languas for the group of *A. galanga* (all of them have names in Languas). This is not in accordance with the Amsterdam proposal, but it involves the fewest changes in nomenclature, and I do not want to make a series of new names for my fourth group which may later have to be changed again.

In considering this matter, I was struck by the fact that Schumann describes the inflorescence of Renealmia as exactly like that of Alpinia section Dieramalpinia. I therefore thought that perhaps the Renealmia problem could be solved by uniting Renealmia with Dieramalpinia; if this were possible, the name Alpinia would be appropriate for the whole group. In order to test this idea, I asked Mr. N. W. Simmonds, of the Imperial College of Tropical Agriculture, Trinidad, if he could send me material of Renealmia for study. This he kindly did, and I have examined flowers and inflorescences of *R. exaltata* Linn. f., and of *Alpinia silvicola* Britton (which Mr. Simmonds regards as a species of Renealmia). My conclusion is that these species should not be placed in the same genus as any from Malaya. A brief report on the Trinidad specimens follows.

In *R. exaltata*, as sent by Mr. Simmonds, each main inflorescence-bract has in its axil a single flower in a tubular bracteole, and within the bracteole also a rudiment of a second flower. It is thus similar in arrangement to Malayan species, but has a cincinnus reduced to a single flower and a rudiment. The other Trinidad species however is quite different. It has one flower in the axil of each main bract, no evidence of a rudimentary second flower, and the bracteole is not tubular nor cup-shaped. If these two species were Malayan, I would place them in different genera; but the striking thing is that they have a lip of closely similar structure, which is unlike anything I know in Malaysia. It looks then as if the tropical American (and presumably also West African) species now called Renealmia show a different series of inflorescence-reductions from the Malaysian species hitherto called Alpinia; at any rate the two species I have seen, though differing in form of inflorescence, have lips which are so similar that they must surely be more nearly allied together than to any Malaysian species. My conclusion then is that Renealmia should remain distinct from the Asiatic species generally known as Alpinia; I think also that the inflorescence-structure of the tropical American species needs further investigation.

KEY TO THE GENERA OF THE ALPINIA TRIBE.

Inflorescence terminal on a leafy stem

Inflorescence bearing single flowers directly on the main axis: bracts usually small, no bracteoles 1. *Cenolophon.*

Inflorescence bearing lateral cincinni of 2 or more flowers, or the apical part with solitary flowers; primary bracts none or small, rarely large; bracteoles (or flowering bracts) always present, small or large

Bracteoles funnel- or cup-shaped 2. *Alpinia.*

Bracteoles not cup-shaped, split to the base, sheathing or flat

Primary bracts wanting (sometimes present near apex of inflorescence); bracteoles usually large, completely enclosing the flower-buds to a late stage (except in *A. mutica*); calyx deeply split at flowering; lip large, mainly orange or orange-yellow with crimson markings 3. *Catimbium.*

Primary bracts present, usually small; bracteoles always small; calyx not deeply split; lip small, white or white and purplish, usually deeply bilobed 4. *Languas.*

Inflorescence breaking through the leaf-sheaths at the side of the aerial pseudo-stem (actually terminal on the stem proper) 5. *Plagiostachys.*

Inflorescence on a leafless peduncle from the rhizome or from the base of a leafy shoot

Inflorescence a compact head, the base or whole surrounded by an involucre of relatively large, usually coloured, sterile bracts, the floral bracts very much smaller than those of the involucre

Bracteoles not tubular (except in *H. leonurus*); lip not stiffly incurved after flowering; stamen as long as lip (except in *H. conica*) 6. *Hornstedtia.*

Bracteoles always tubular; lip (at least the fleshy basal part) stiffly incurved after flowering; stamen always much shorter than lip

Inflorescences on a long peduncle raised well above ground; lip not much longer than corolla-lobes 7. *Phaeomeria.*

Inflorescence on short peduncle, always embedded in the ground; lip much longer than corolla-lobes 8. *Achasma.*

Inflorescence not surrounded by a conspicuous involucre of sterile bracts which are larger than the flowering bracts

Inflorescence cone-like, with imbricating bracts; bracts usually persistent, sometimes decaying early

Inflorescence embedded in the ground

Bracteoles tubular 9. *Amomum.*

Bracteoles not tubular 10. *Elettariopsis.*

Inflorescence raised above the ground 9. *Amomum.*

Inflorescence lax, not cone-like, the primary bracts not imbricating

Inflorescence erect or more or less decurved, not entirely prostrate nor buried in the ground

Rachis of inflorescence bearing single flowers; lip narrow, split to the base 11. *Geocharis.*

Rachis bearing cincinni of 2–5 flowers each; lip not split to the base 12. *Geostachys.*

Inflorescence prostrate, sometimes entirely underground (except for the tubes of the flowers)

Flowers in cincinni, the floral bracts tubular 13. *Elettaria.*

Flowers solitary, on creeping axis, the bracteoles or floral bracts not tubular 10. *Elettariopsis.*

1. CENOLOPHON Blume

Inflorescence erect or drooping, not branched, bearing only solitary flowers on short pedicels (a rudimentary second flower rarely present in *C. oxymitra*). *Primary bracts* usually small, not deciduous from the base, but sometimes breaking off above the base, in one species hooded over the flower buds. *Bracteoles* or secondary bracts absent. *Calyx* tubular, more or less split on one side. *Corolla-tube* a little shorter than calyx; lobes white, cream or orange. *Lip* broad and finely crisped, more or less flushed with orange, with crimson marks; entrance to tube of flower at base of lip rather broad, not filled with hairs, a fleshy papillose swelling on either side of base of filament. *Staminodes* various, usually present. *Anther* often deep

red, the connective usually (but not always) produced to form a conspicuous crest. *Fruit* usually ellipsoid, sometimes very much longer than wide, smooth or ribbed.

This genus was founded by Blume in 1827, his only species being *C. rubrum* from Celebes. The description is very brief, and Schumann states that no specimen can be found in Blume's herbarium at Leiden. There are however two significant points in the description; the inflorescence is racemose and the anther crested. Horaninow is the only later author to take up Blume's genus; he included in it *Amomum vitellinum* Lindl. as well as *C. rubrum* Bl. Lindley's species was well illustrated in the Botanical Register and there is no doubt that it is a Malayan species, common on Penang Hill. No other species have later been added to the genus, but it was used as a section of Alpinia by Baker, Ridley and Schumann. Schumann did not clearly recognize the complete absence of bracteoles or secondary bracts. He included only the Malayan species called Cenolophon by Ridley and one from Ceylon which is altogether doubtful. On the other hand, he placed in his section Probolocalyx several species which may well belong to Cenolophon, but the bracts are not described; some of these are from Celebes and one of them might duplicate Blume's original *C. rubrum.*

This genus has doubtless originated from Alpinia; but except for an occasional rudiment in *C. oxymitra* it has completely lost all trace of the cincinni, the inflorescence having become a simple raceme like that found (for example) in Orchidaceae.

The Malayan species have flowers of moderate size, usually close together and always on very short pedicels, thus forming a rather compact slender inflorescence, except in *C. petiolatum* where it is drooping and more lax. *C. oxymitrum* is interesting in having cucullate bracts which break across near the base when the bud within them elongates. Almost all Malayan species have long petioles. *C. vitellinum* typically has short bracts, but the var. *cannifolium,* which seems a rather inconstant one, has them quite long.

KEY TO THE MALAYAN SPECIES OF CENOLOPHON

Anther crested; leaf-sheaths at most short-hairy
- Bracts hooded — 1. *C. oxymitrum.*
- Bracts not hooded
  - Leaves broadly rounded or cordate at base
    - Rachis 7–10 cm. long; crest of anther broad, 3-lobed; calyx with ovary 2 cm. long — 2. *C. macrostephanum.*

Rachis to 25 cm. long; crest crescent-shaped, irregularly toothed; calyx with ovary 3 cm. long 3. *C. pulcherrimum.*

Leaves cuneate at base

Calyx with ovary 3 cm. long; inflorescence drooping; corolla-lobes 2·5 cm. long; lip buff towards the base; anther-crest crescent-shaped, toothed 4. *C. petiolatum.*

Calyx with ovary under 2 cm. long; inflorescence erect; lip entirely orange-yellow with crimson veins; anther-crest 3-lobed, middle lobe largest 5. *C. vitellinum.*

Anther not crested; leaf-sheaths rather long-hairy (hairs 2 mm. or more long)

Hairs on lower surface of leaves 1·5–2 mm. long; petiole to 3 cm. long; leafy stems without conspicuously ribbed sheaths at base 6. *C. mollissimum.*

Hairs on lower surface of leaves much shorter; petiole to 8 cm. long; leafy stems with several conspicuously ribbed sheaths at the base 7. *C. Corneri.*

1. **Cenolophon oxymitrum** (K. Schum.) Holtt., **comb. nov.** *Alpinia oxymitra* K. Schum., Bot. Tidsskr. 24: 268. 1902. Pflznr. Zingib. 336, fig. 40, J, K. Gagnep. Fl. Gen. Indochine 6: 93. *A. comosa* Ridl., J.S.B.R.A.S. 32: 170. 1899. Flora 4: 286 (non Jacq.).

Stems about 2–3 m. tall, close together, bases whitish, with brown scale-sheaths. *Leaves* rather leathery, to about 40 by 5 cm., glabrous except for stiff hairs on edges, apex acuminate-caudate (cauda to 4 cm. long), base cuneate; petiole 2–5 mm. long; ligule about 5 mm. long, not bilobed, fringed with short hairs. *Inflorescence* vertical, at an angle to the sloping stem. *Rachis* to about 17 cm. long, much thickened at fruiting, densely short-hairy, bearing very numerous close single flowers which closely overlap each other when in bud; flowers 5 or 6 open together, in sequence from base to apex of rachis. *Bracts* about 1·4 cm. long, densely appressed-hairy, dorsally prolonged upwards into a pointed hood 3–4 mm. long beyond the apex of the lamina-edge, breaking irregularly near the base as the buds elongate, the persistent base not deciduous. *Pedicel* hardly visible at flowering, elongating to 3 mm. at fruiting and apparently partly joined to the base of the bract. *Ovary* and *calyx* densely appressed-hairy, white, total length about 1·2 cm.; teeth of calyx short, close together, other side of tube split about 5 mm. *Corolla-tube* about 5 mm. longer than calyx, tube and lobes white, densely hairy; lobes about 1·4 cm. long, laterals 4 mm. wide, dorsal a little wider and hooded. *Lip* barely 2 cm. long, broadly obovate, the apex somewhat deflexed and bilobed, white flushed with yellow towards the base, with crimson markings on either side of the midline near the base. *Staminodes* fan-shaped, 4–5 mm. long, apical margin 3–4 mm., white with crimson spots at the base.

Filament 1 cm. long, short-hairy; anther 5 mm. long without the crest, white, hairy; crest 2·5 mm. long, slightly bilobed, not wider than the anther. *Fruit* narrowly ellipsoid, 5 cm. long and barely 1·5 cm. diameter, longitudinally ribbed, brownish-ochre, short-hairy near base and apex, which carries the persistent calyx.

This interesting species occurs in Siam and Indochina; in Malaya it has only been collected in Kedah and is evidently at its southern limit. Ridley described the bracts as "cap-shaped" in his field notes, but this was printed as cup-shaped, and so latinized by Schumann as *cupulatae*, giving a quite inaccurate impression. The staminodes were described by Ridley as "inch long", with a gap before inch, evidently intended for the necessary fraction; this again misled Schumann, who put the species in quite the wrong place, at the end of his subgenus Autalpinia.

The name given to this species by Ridley, *A. comosa*, is pre-occupied by *A. comosa* Jacq. (*Costus comosus*); the later name *A. oxymitra* is available.

Gagnepain evidently mistook the broken bases of the bracts for primary bracts (which he said were small or absent) and the upper cucullate part of the bracts for bracteoles.

Corner reports this species as frequent in secondary forest near Kota Bahru, Kelantan. In Corner's Kelantan specimens there are remains of two rudimentary secondary flowers: I cannot distinguish the relation of the second flower to the bract.

SPECIMENS. Cult. in Hort. Bot. Singap., origin Kedah, Ridley 4443 (type of *A. comosa*). *Kedah.* Kedah Peak 1,500 feet, Ridley s.n. June 1893. Bukit Tunjang, 950 feet, S.F.N. 13149 (Haniff). *Kelantan.* K. Pulai Chondong, S.F.N. 33447 (Corner).

2. **Cenolophon macrostephanum** (Bak.) Holtt., **comb. nov.** *Amomum macrostephanum* Bak., F.B.I. 6: 243. 1892. *Alpinia macrostephana* Ridl., J.S.B.R.A.S. 32: 175. 1899. Flora 4: 284.

Stems 1·2–2·5 cm. tall. *Leaves* to about 60 by 9 cm., short-hairy on edges and on midrib beneath, apex shortly caudate, base abruptly and very unequally cordate; petiole to about 12 cm. long, slender, short-hairy; ligule about 1 cm. long, bilobed, short-hairy; sheaths short-hairy. *Rachis* of inflorescence slender, 7–10 cm. long. *Bracts* probably small, deciduous. *Ovary* at flowering hairy, c. 3 mm. long. *Calyx* with ovary about 2 cm. long, shaped as in *A. petiolata*. *Corolla-tube* about as long as calyx; lobes 2 cm. long, short-hairy. *Labellum* about 2·5 cm. long, "crimson, edged yellow" (Wray). *Filament* about 1·2 cm. long; anther without crest 5 mm. long, crest apparently about 5 mm. long beyond the pollen-sacs, broad and crisped, said to be 3-lobed.

This species is only known from the original collection (Larut, Perak, 500–1,000 feet, King's Collector 1905), and one by Wray, also from Larut (no. 3965). It is related to *C. petiolatum*, but has smaller flowers with a larger anther-crest of different shape, and strongly cordate leaves. Further data are needed to complete the description.

3. **Cenolophon pulcherrimum** (Ridl.) Holtt., **comb. nov.** *Alpinia pulcherrima* Ridl., Journ. F.M.S. Mus. 4: 79. 1909. Flora 4: 284.

Habit of *C. petiolatum*, differing as follows: *Leaves* broadly rounded or subcordate at base, very short-hairy on the lower surface; petioles to 20 cm. long. *Inflorescence* to 25 cm. long or even more. *Flowers* rather larger than in *C. petiolatum*, calyx 2·5 cm. long. *Labellum* less flushed with orange (?). *Fruit* 7·5 cm. long.

This may ultimately rank as a variety of *C. petiolatum*. The only clear distinction is in the shape of the leaves. Ridley states the anther-crest differs by being 5-lobed, but it appears to be very much the same shape as in *C. petiolatum*, where it is irregularly toothed, the teeth large and lobe-like. The only specimens known are from the neighbourhood of Cameron Highlands. The Semangkok Pass (Sempang Mines) specimen quoted by Ridley is *C. petiolatum*.

Specimens. *Pahang.* Telom, Ridley 13850 (Type). Cameron Highlands, Batten-Pooll, s.n. November 1939. Lubok Tamang, 3,500 feet, Henderson 11102 (Herb. F.M.S. Mus.).

4. **Cenolophon petiolatum** (Bak.) Holtt., **comb. nov.** *Alpinia petiolata* Bak., F.B.I. 6: 255. 1892. Ridl., J.S.B.R.A.S. 32: 175. 1899. Flora 4: 284.

Stems very close together, 1–1·5 m. tall, pinkish towards the base. *Leaves* purplish beneath when young, to about 45 by 10 cm., widest about 1/3 from apex, glabrous except for short-hairy edges, apex shortly caudate, base gradually narrowed; petiole to 10 cm. or more long, rather slender, glabrous or very short-hairy; ligule bilobed, to about 1·2 cm. long, edge hairy, surface glabrous or rarely very short-hairy; sheath glabrous or short-hairy, with the ligule often suffused with pink near the edges. *Inflorescence* slender, drooping, to 20 cm. long, with 2 narrow sheaths 10–15 cm. long at the base. *Rachis* red, with rather sparse spreading hairs about 1 mm. long, bearing single flowers 3–10 mm. apart. *Bracts* about 2 mm. long, hairy, near apex of inflorescence sometimes 1 cm. or rather more long, narrow. *Pedicels* 2–4 mm. long. *Ovary* at flowering 6 mm. long and 3 mm. wide, covered with soft spreading hairs 1 mm. long. *Calyx* white, slightly flushed with pink, 2·5 cm. long, tubular, with 3 rather broad hairy shortly pointed lobes 3 mm. long, spilt 1 cm. or more down the other side. *Corolla-tube* a little shorter than the calyx; lobes creamy-white, about 2·5 cm. long, the dorsal 1 cm. wide; laterals 8 mm. wide, apices of all concave and nearly alike. *Lip* obovate,

hardly lobed, 4·5 cm. long and 3·5 cm. wide when flattened, edges finely crisped throughout, buff towards the base, the distal half flushed with orange with numerous radiating crimson streaks; a small papillose hump at base of lip on either side at junction with filament: throat of flower papillose, rather widely open, not closed by hairs. *Staminodes* none, or very small teeth. *Filament* 1·5 cm. long, white; anther 1·1 cm. long without crest, pink towards the apex; crest of anther pale buff-yellow, crescent-shaped with forward pointing lateral tips 7 mm. long, the middle 3 mm. long beyond the pollen-sacs, the edge deeply toothed. *Stylodes* fleshy, blunt, 3 mm. long, not enclosing style. *Fruit* ellipsoid, 5 cm. long, hairy, red (not seen).

This species is apparently not uncommon in mountain forests, and has been collected on the Taiping Hills, the Main Range at Fraser's Hill and G. Tampin, and G. Tahan. As the inflorescence and flowers are pendulous, the lip is uppermost. The large anther-crest may be of importance in connection with the visits of pollinating insects. The length of the bracts is variable among plants of the same collection.

SPECIMENS. *Perak.* Larut, 2,500–4,000 feet, King's Collector 6357 (Type collection). Maxwell's Hill, Ridley s.n. June 1893; Curtis s.n. September 1889. Tea Gardens, Curtis s.n. May 1890. Larut Hill, Curtis s.n. Xmas 1901. G. Haram, Scortechini 697. *Pahang.* Fraser's Hill, S.F.N. 8434, 8596 (Burkill and Holttum); S.F.N. 33153 (Corner). G. Tahan, Ridley s.n. July 1911. *Selangor.* Sempang Mines (= Semangkok Pass) Ridley 12031. *Negri Sembilan.* G. Tampin, 2,400 feet, S.F.N. 3182, 3175 (Burkill).

5. **Cenolophon vitellinum** (Lindl.) Horan. Prodr. 36. 1862. *Amomum vitellinum* Lindl., Journ. Hort. Soc. 2: 245. 1847. Bot. Reg. 1847: t. 52. *Alpinia Wrayi* Bak., F.B.I. 6: 254. 1892. *Languas vitellina* Alst., Handb. Fl. Ceyl. 6: 282. 1931.

Stems to about 1·2 m. tall. *Leaves* to about 35 by 7 cm., entirely glabrous except for hairs on edges of blade and edges of ligule, apex shortly caudate-acuminate, base cuneate, petiole to about 2 cm. long; ligule to 1 cm. long, usually bilobed. *Rachis* of inflorescence erect, to about 7 cm. long, short-hairy, bearing many single flowers close together; basal sheaths 1 or 2, rather short and narrow, one often replaced by a small leaf. *Bracts* to about 2 mm. long. *Pedicels* to about 2 mm. long, short-hairy. *Ovary* at flowering 3 mm. long, densely hairy, much longer than wide. *Calyx* with ovary c. 1·8 cm. long; short-hairy throughout; split 5 mm. down one side. *Corolla*-tube a little shorter than calyx; lobes about 2 cm. long, rather narrow, golden yellow. *Labellum* c. 2·5 cm. long, obovate, edges crisped, entirely orange-yellow with crimson veins. *Staminodes* short, red. *Filament* 1 cm. long, anther 7 mm. long without crest; crest large, 3-lobed to the base, the middle lobe largest, edges of lobes toothed. *Fruit* narrowly ellipsoid, short-hairy, containing few large seeds.

This species was described by Lindley from plants cultivated in England, of unknown origin, and illustrated in the Botanical Register. There is little doubt that it came from Penang, where plants are evidently fairly common in the hill forest, from 1,000 feet altitude upwards. The species has also been found in Selangor, Negri Sembilan and Johore, (including the var. *cannifolia*) but not in Perak. Baker's description (under *A. Wrayi*) in the F.B.I. is inaccurate in stating "peduncle from the rootstock". The specimen of King's Collector 1719 in the Singapore herbarium is quite normal, and no doubt *A. vitellina*.

SPECIMENS. *Penang*. Western Hill, 2,300 feet, S.F.N. 35889 (Nauen). Top of Hill, Ridley 7237. Government Hill, 2,500 feet, Curtis s.n. June 1892. Tek Soon's Bungalow, 1,000 feet, Curtis s.n. May 1898. Penang, 2,000–3,000 feet, King's Collector 1719. *Selangor*. Dusun Tua, Ridley 7792. *Johore*. Batu Pahat, Ridley s.n. November 1900.

var. cannifolium (Ridl.) Holtt., **stat. nov.** *Alpinia cannifolia* Ridl., J.S.B.R.A.S. 32: 174. 1899. Flora 4: 285. *Languas cannifolia* Burk., Kew Bull. 1935: 318.

Leaves to 15 cm. wide with petiole to 8 cm. long; *ligule* sometimes short-hairy on surface; *rachis* of inflorescence to 12 cm. or more long, basal sheaths to 20 cm. long; *calyx* usually more densely hairy.

This variety, ranked as a species by Mr. Ridley, is not very constant. On Penang Hill are wide-leaved plants (11 cm. wide) which have short petioles and do not otherwise differ from typical *A. vitellina*; there are also plants with unusually hairy calyx. On the other hand, at the type locality for var. *cannifolia* (Dusun Tua), are plants with narrow leaves, moderately long petioles (3 cm.), long inflorescence and nearly glabrous calyx. Further field study in the Dusun Tua district is necessary.

SPECIMENS. *Penang*. Moniot's Road, 2,000 feet, S.F.N. 3340 (Burkill). *Selangor*. Dusun Tua, Ridley s.n. May 1896. *Negri Sembilan*. Bukit Sutu, Alvins 1893. G. Berumbun, Alvins 1864.

6. **Cenolophon mollissimum** (Ridl.) Holtt., **comb. nov.** *Alpinia mollissima* Ridl., Flora Mal. Penin. 5: 339. 1925.

Stems with flowers to about 1·20 m. tall. *Leaves* to about 50 by 8 cm., lower surface softly hairy throughout, hairs c. 1·5–2 mm. long, apex abruptly pointed, the point c. 1·2 cm. long and 4 mm. wide at the base, base narrowly cuneate; petiole to 3 cm. long, hairy like the blade; ligule to 2 cm. long, similarly hairy; sheaths also hairy. *Inflorescence* with 2 or 3 broad hairy sheaths near the base; rachis c. 6 cm. long, densely hairy, bearing 20 or more solitary flowers. *Primary bracts* less than 1 mm. long. *Pedicels* densely hairy, 2 mm.

long. *Calyx* with ovary c. 1·8 cm. long, 3-lobed, covered rather sparsely with long hairs, densely on the ovary and at tips of lobes. *Corolla-tube* a little shorter than calyx, lobes c. 1·5 cm. long, hairy on backs, orange (?). *Labellum* rather longer than corolla-lobes, orange-yellow. *Staminodes* deep red, about 3 mm. long. *Filament* nearly 1 cm. long, hairy; anther 4 mm. long, deep red, with rather long hairs on pollen-sacs.

This species has been collected twice only. The dimensions of the flower given by Ridley are very inaccurate. He evidently mistook the staminodes for lateral petals. The details given above are from dried specimens in Singapore, and colours from my field notes.

SPECIMENS. *Johore.* G. Bĕlumut, 2,300 feet, S.F.N. 10838 (Holttum, type). *Pahang.* G. Tapis, 1,600 feet, S.F.N. 28792 (Symington).

Cenolophon Corneri Holtt., **sp. nov.**

Rhizoma in superficie terrae repens; *caules foliati* conferti, 120–150 cm. alti, basin versus vaginis plurimis imbricatis valde costatis, in juventute purpureis vel brunneis, intus lacunosis, maxima 30 cm. longa, vestiti; *lamina* folii ad 60 cm. longa et 12 cm. lata, oblanceolata, apice breviter acuta, basin versus sensim angustata, marginibus ciliatis, subtus breviter hirsuta; *petiolus* ad 10 cm. longus, brevissime hirsutus; *ligula* ad 2 cm. longa, capillis 3 mm. longis dense hirsuta; *vagina* prope petiolum more ligulae hirsuta; *rachis* inflorescentiae erecta, ad 20 cm. longa, valida, minute hirsuta, flores confertos multos et basi vaginas duas non deciduas ad 15 cm. longas et 2·5 cm. latas ferens; *bracteae* 1 mm. longae vel minores; *pedicelli* 1 mm. longi; *calyx* pallide luteus, cum ovario fere 2 cm. longus, glaber, fissus 8 mm., dentibus brevibus latiusculis; *ovarium* breviter hirsutum; *corollae* tubus quam calycem leviter brevior, lobi minute hirsuti, pallide flavescentes, apicem versus colore nitentiores, 16 mm. longi, fere aequales, basi 7–8 mm. lati, lobus dorsalis apice concavus; *labellum* 2·2 cm. longum, obovatum, marginibus basin versus inflexis, apicem versus patentibus, valde crispatis, apice breviter (3 mm.) bilobatum, pallide luteum, medio fascia longitudinale lutea nitente, basi et in fauce maculis rubris, utroque latere striis rubris c. 5 e fascia lutea radiatis ornatum; *staminodia* anguste triangularia, acuta, 3 mm. longa, rubra, apice luteo et rubro maculata; *filamentum* rubicundum, 12 mm. longum; *anthera* 5 mm. longa, minute papillosa, sanguinea, thecae atropurpureae, connectivus apice non cristatus; *stylus* et stigma pallide lutei, stigma breviter ciliatum; *fructus* rotundatus (fructus immaturus 1 cm. longus solum visus). TYPUS: *Trengganu*, Kemaman, Bukit Kajang, 500 feet, S.F.N. 30506, leg. Corner.

This species is near *C. mollissimum*, with which it agrees approximately in the size of flowers, and the dark red crestless anther; but the lip of *C. Corneri* appears to be differently coloured, the inflorescence is much longer, the leaves are only very short-hairy on the blades, the petioles are much longer, and the peculiar basal ribbed sheaths are apparently distinctive (not or hardly developed in *C. mollissimum*). Mr. Corner reports the species as not infrequent on hillsides and in swamps at Bukit Kajang.

2. ALPINIA

Inflorescence erect or drooping, short or fairly long, bearing numerous cincinni, each of several flowers. *Primary bracts* usually rather small, not brightly coloured, often soon deciduous, but in one species large and persistent. *Stalks of cincinni* short to rather long. *Secondary bracts* more or less broadly funnel-shaped or cup-shaped, the apex obliquely truncate, persistent, each one at first entirely enclosing the part of the cincinnus beyond it. *Calyx* tubular or funnel-shaped, not deeply split. *Corolla* tube about as long as or sometimes longer than calyx, lobes white or orange; dorsal corolla-lobe with subapical erect more or less conical spur, usually hairy outside, lateral lobes concave towards the tip but not spurred. *Labellum* white or white and orange, or entirely orange, with purple markings, sometimes broadly ovate and strongly concave at the base, sometimes cuneate at the base with a broad rather shallow 3-lobed blade. *Staminodes* usually present, variable in shape, usually not very narrow. *Anther* sometimes crested. *Fruit* green or orange, spherical, more or less short-hairy.

This is Schumann's subgenus Dieramalpinia of Alpinia (see note above on page 129). The essential character is the funnel-shaped secondary bracts, each of them in turn entirely enclosing that part of the cincinnus which is beyond it, and later persisting more or less intact to the fruiting stage, never deciduous at the base. Such an arrangement is found in Geostachys, which is no doubt a specialized and closely allied group, and also in Elettaria, which is more specialized and less nearly related. The remains of it, namely one tubular bracteole containing a single flower, is found in Amomum, Achasma and Phaeomeria. In Hornstedtia change has gone further, the bracteole being split to the base, except in *H. leonurus*, in which each primary bract has two flowers in its axil, these two provided with tubular bracteoles or secondary bracts arranged exactly as in Alpinia. It seems to me indeed that this inflorescence-form is basic for a great part of the Zingiberaceae. If this view is correct, one would expect this basic group of Alpinia to have more or less distinct sub-groups, and Schumann's sections are an indication of such, though they do not appear in all cases to be satisfactory. One such sub-group is that of *A. conchigera*, for a species of which Miquel proposed the name Strobidia (for *A. sumatrana*). I have not sufficient data to pass critical judgment on Schumann's groups, but when better information is available they will certainly need revision.

One can derive the genera Catimbium, Languas and Cenolophon from Alpinia as thus limited by a change from cup-shaped to open secondary bracts, which then become deciduous at the base, or by complete suppression of such bracts, and by reduction of the number of flowers in each cincinnus, in Cenolophon always to one flower only.

There are seven Malayan species at present known in the genus as now restricted. All appear to be common at least in certain parts of Malaya, except *A. denticulata*, which is without near allies, is very peculiar in its labellum, and is only known from a single locality, and *A. capitellata*, also a very remarkable species known from a restricted area, but closely allied to *A. javanica*. *A. javanica* and *A. Rafflesiana* occur in nearly all parts of Malaya; *H. pahangensis* is locally abundant in the lowlands of Pahang but little beyond that state; *A. Murdochii* is a mountain species, found at several localities. *A. conchigera* is the only species known to be widely distributed outside Malaya.

KEY TO THE MALAYAN SPECIES OF ALPINIA

Flowers small; calyx 3 mm. long, corolla-lobes and lip 5 mm. long — 1. *A. conchigera.*

Flowers much longer

Lip very narrow, narrower than dorsal corolla-lobe except near apex — 2. *A. denticulata.*

Lip nearly as broad as long

Inflorescence short, entirely enclosed by several very large, broad, basal sheaths (to 8 cm. long and 7 cm. wide) and very large primary bracts — 3. *A. capitellata.*

Inflorescence not completely so enclosed; basal sheaths and bracts smaller

Lip orange, or orange with a white border

Whole flower orange, lip 2·5 cm. long: outer secondary bracts little over 1·2 cm. long — 4. *A. Rafflesiana.*

Corolla-lobes white, or white tipped with pink; lip with white border; secondary bracts to 2 cm. long, broadly cup-shaped — 5. *A. javanica.*

Lip white with purplish markings

Secondary bracts 2–3 cm. long; lip 3 cm. long with a large purple area on each side of the mid-line and some dark purple streaks; anther crested — 6. *A. pahangensis.*

Secondary bracts 1–1·5 cm. long; lip 2 cm. long without such large purple patches; anther not crested 7. *A. Murdochii.*

Doubtful species 8. *A. Seimundii.*

1. **Alpinia conchigera** Griff., Notul. 3: 424, t. 354. 1851. Ridl., J.S.B.R.A.S. 32: 162. 1899. Flora 4: 278. *Languas conchigera* Burk., Kew Bull. 1930. 37. **Fig. 16.**

Flowering stems to about 120 cm. tall, growing close together. *Leaves:* to about 25 by 5 cm., glabrous or hairy on the midrib beneath, apex shortly acuminate, not deflexed, base cuneate, *petiole* to about 5 mm. long, short-hairy beneath or glabrescent; *ligule* to about 5 mm. long, short-hairy or glabrescent. *Inflorescence* to about 20 cm. long above the base of the uppermost leaf, sometimes with a single basal main branch up to about 8 cm. long, sometimes bearing short cincinni only; cincinni many, 2 cm. long including flowers, rachis slender, short-hairy. *Primary bracts* to 5 mm. long, often shorter or soon breaking off, sometimes very small, or absent on the lower cincinni. *Stalk* of cincinnus 2–3 mm. long, hairy. *Secondary bracts* broadly funnel-shaped, 4–6 mm. long, obliquely truncate with a hairy edge, hairy also down the dorsal keel. *Pedicel* of flower to about 5 mm. long. *Ovary* at flowering 2–3 mm. long, pear-shaped, glabrous and shining, green. *Calyx* cup-shaped, glabrous, 3 mm. long and wide, broadly 3-lobed, very pale green. *Corolla* hairy outside, white or greenish white, translucent, tube as long as calyx; lobes concave, dorsal 7 by 4 mm., laterals a little smaller. *Lip* obovate, strongly concave, about 5 mm. long, yellowish or pinkish white with 4 or 5 red streaks on each side; at the base an almost quadrate red staminode, c. 1·5 mm. long and wide, on either side, the two lying almost in one plane across the base of the filament, their edges touching; median longitudinal band of lip with irregularly wrinkled surface, terminating at the base in a raised slightly retuse callus in front of the base of the staminodes. *Filament* rather slender, curved, yellowish to pinkish, 5 mm. long; anther 2 mm. long. *Fruit* pink or red, glabrous, spherical, c. 0·8 cm. diameter, with remains of flower at apex; seeds 3–5, relatively large, strongly aromatic, 1 or 2 in each loculus.

Native names: Langkuas Ranting, Langkuas kĕchil, Jĕrnuang etc.

Distribution: Eastern Bengal to Indo-China and south to Malaya and Sumatra.

This species is common in open places, especially in rather wet ground, in all parts of Malaya. Gagnepain's description agrees exactly with Malayan plants. The wrinkled median band of the lip consists of a loose skin separated by a cavity from the main substance of the lamina. It is raised at the base to form the callus-like object but this also is hollow, and not really a callus; it almost touches the staminodes and nearly closes the throat of the flower.

This species is peculiar in its small size and in the structure of the lip, and is perhaps not very closely related to the other species now included in this genus. For uses, see Burkill's *Dictionary.*

2. **Alpinia denticulata** (Ridl.) Holtt., **comb. nov.** *Hedychium denticulatum* Ridl., J.S.B.R.A.S. 32: 102. 1899. *Odontychium denticulatum* K. Schum. Pflanzenr. Zingib. 59. 1904. Ridl., Flora 4: 243.

Stems close together, about 60 cm. tall. *Leaves* to 35 by 7·5 cm., surfaces scabrid to touch if rubbed towards the base, edges bearing short stiff hairs, apex acuminate, base rather broadly cuneate; petiole 5–10 mm. long, glabrous, ligule c. 4 mm. long, fringed with hairs, not lobed. *Inflorescence* erect, to 30 cm. long, with 2 or 3 narrow sheaths at the base, the lowest cincinnus in the axil of one of them. *Rachis* densely short-hairy, bearing very numerous cincinni. *Primary bracts* hairy, 1–2 mm. long near base of inflorescence, rest about 1·8 cm. long, narrow, acute. *Stalks* of cincinni to 5 mm. long; each with 3–4 flowers. *Secondary bracts* rather narrowly funnel-shaped, obliquely truncate, hairy, with a fringe of longer hairs, to 1·5 cm. long. *Pedicels* of flowers about 3 mm. long. *Ovary* at flowering short-hairy, about 2·5 mm. long. *Calyx* with ovary about 1·5 cm. long, tubular, not deeply split, the teeth subequal, hairy, short. *Corolla-tube* slender, about as long as calyx or little longer: lobes narrow, base greenish, tips pink, the dorsal one 1·5 cm. long with a strongly concave rounded hooded apex 4 mm. long, the laterals shorter, all hairy near the tip. *Labellum* about 2·2 cm. long, basal 2/3 about 2–3 mm. wide; red with thickened edges; apical part green, 3-lobed, lateral lobes about 3 mm. long and 1 mm. wide, falcate, acute, midlobe 6 mm. long, deeply bilobed, the lobules about 2 mm. wide, with toothed edges. *Staminodes* very narrow, about 6 mm. long, red. *Filament* 1·7 cm. long, curved, white; *anther* 4 mm. long, without a crest, pinkish. *Fruit* spherical, about 1·5 cm. diameter, short-hairy near base and apex, crowned with the persistent calyx; seeds as in Alpinia.

This remarkable species was described by Ridley as a Hedychium, on account of the very narrow lip and rather long staminodes, which gives the flower a superficial resemblance to that genus. As Schumann pointed out however, in every other character of inflorescence and fruit the species exactly belongs to Schumann's section Dieramalpinia of the genus Alpinia. On account of the staminodes alone he made for the species a new genus; but the staminodes are not much larger than in some other species of Schumann's Alpinia. The very narrow curiously lobed lip is the only quite peculiar character. No nearly related species appears to have been described.

The species has only been collected in one locality, near Lumut (Dindings), Perak, by Mr. Ridley in the years 1896, 1897 and 1898, under numbers 7822 and 9455 (1897 specimen without number).

3. **Alpinia capitellata** Jack., Mal. Misc. 2, no. 7: 4. 1820. Ridl., J.S.B.R.A.S. 32: 172. 1899. Flora 4: 283.

Vegetatively similar to *A. javanica*. *Inflorescence* drooping, the rachis hardly 5 cm. long, the whole completely covered by the broad basal sheaths and the primary bracts which are nearly as large; basal sheaths to about 8 cm. long and 7 cm.

wide, uppermost primary bracts about 5 cm. long and 3 cm. wide. *Cincinni* short, structure as in *A. javanica*. *Flowers* as in *A. javanica*, with the colouring of *A. javanica* var. *colorata*. *Fruit* as in *A. javanica*, covered by the persistent sheaths and bracts.

Jack described *A. capitellata* from plants which he found near Benkoelen, Sumatra. His description is not quite clear, but it could apply to the peculiar plants from Province Wellesley and Perak which Ridley so named. These are certainly very near *A. javanica*, but have a short condensed inflorescence completely covered by the large sheaths and bracts, the whole looking from the outside rather like a gigantic rose or some such "double" flower with broad petals.

In *A. javanica* the basal sheaths of the inflorescence are longer and narrower; above the sheaths, the cincinni are in the axils of quite small bracts. In *A. capitellata* there is a gradual transition from the very broad basal sheaths to the large primary bracts. So far as specimens and Mr. Ridley's description go, there seems no clear difference between the flowers of *A. capitellata* and *A. javanica* var. *colorata* (which occurs only in Perak).

SPECIMENS. *Perak*. G. Tungul, Dindings, Ridley 7227. *Province Wellesley*. Ara Kuda, Ridley 7014.

4. **Alpinia Rafflesiana** Wall. apud Bak. in Hk. Ic. Pl. t. 1963. 1891. Ridl., J.S.B.R.A.S. 32: 170. 1899. Flora 4: 281. *Languas Rafflesiana* Burk., Kew Bull. 1935. 318. *Alpinia aurantiaca* Ridl., J.F.M.S. Mus. 4: 78. 1909.

Stems to about 1·5 m. tall (mountain plant to nearly 2 m.). *Leaves* to about 60 by 8 cm., short-hairy on both surfaces and edges, sometimes almost glabrous above except in the grooved midrib, apex usually caudate (sometimes hardly so), base narrowly cuneate; petiole short-hairy, very variable in length, from 5 mm. on lower leaves to 4 cm. or more on upper leaves; ligule to 1·2 cm. long, fringed with hairs, usually with two brown swollen areas, one each side just above the petiole; upper part of sheath hairy below petiole and on edges. *Inflorescence* short and compact, horizontal, covered when young by 2 or 3 broad sheaths to about 7 cm. long, their edges fringed with hairs. *Rachis* to about 8 cm. long, stout, densely short-hairy, bearing many short cincinni, which usually quite obscure it. *Primary bracts* to 1·2 cm. long the upper ones often shorter (down to 4 mm.) short-hairy, the apex ciliate. *Stalks* of cincinni very short (1–2 mm.); 1–3 flowers to each cincinnus. *Outer secondary bracts* 1·2 cm. long, funnel-shaped and obliquely truncate, fringed with hairs, reddish. *Pedicel* c. 5 mm. long, more or less densely hairy. *Calyx* with ovary 1·5 cm. long, deep orange-red or dull rose red, broadly and subequally 3-lobed, short-hairy; the ovary with longer hairs, green. *Corolla-tube* 5–10 mm. longer than calyx, barely 3 mm. diameter, short-hairy, pale orange; lobes orange or pinkish orange, the dorsal one with darker tip, 2 cm. long or rather more; dorsal lobe 1·2 cm. wide near base with a bluntly conical

concave apex 4 mm. long, hairy outside at the tip; laterals about 7 mm. wide, their apices slightly concave. *Labellum* about 2·5 cm. long, orange-yellow to orange, veined or flushed with orange or crimson on the lobes, and spotted with the same towards the base, broadly ovate-cordate and strongly concave, widening abruptly at the base with two rounded auricles that stand on either side of the stamen, the apex pointing forwards, crinkled and slightly retuse. *Staminodes* triangular, about 3 mm. long. *Filament* about 1·2 cm. long and 3·5 mm. wide, crimson towards the base, grading to orange; *anther* 7·5 mm. long, very broad, yellow to orange, the connective broadly cleft at the apex, with a very small tooth on either side of the sinus. *Fruit* green, round, *short-hairy*, about 2 cm. diameter, with persistent calyx at tip.

This is one of the commonest Malayan species of the genus, being found in forest in all parts of the country, in the lowlands and up to 4,000 feet on the hills. Mountain plants may be more hairy on bracts etc. The very compact inflorescence of almost entirely orange or yellow-orange flowers is distinctive. There is no record of the species occurring outside Malaya; but as it is so common in this country it is almost certain to occur in Sumatra and Borneo also. There is one Sumatran specimen in the Singapore herbarium which might belong to *A. Rafflesiana*, but the material is not adequate for certain identification.

Ridley described *Alpinia aurantiaca* from a specimen collected by him on the lower slopes of G. Berumban (Cameron Highlands) at 4,500 feet altitude. This has a more hairy inflorescence than usual in *A. Rafflesiana*, rather longer bracts and possibly a slightly larger calyx, a shorter corolla-tube (not longer than the calyx). Ridley says that the lip is shorter than the corolla-lobes, which it is not, and also that it has two short tails at the tip; perhaps it was unusually deeply bilobed. It is exactly *A. Rafflesiana* in leaf-characters colour and shape of flowers, and I include it with *A. Rafflesiana*, possibly as a mountain variety. The stems were six feet tall.

var. hirtior (Ridl.) Holtt., **stat. nov.** *A. aurantiaca* var. *hirtior* Ridl., Flora 4: 282. 1924.

All parts of plant more hairy, the hairs on inflorescence much longer; the primary bracts 2 cm. long; corolla-tube not longer than calyx; corolla-lobes and lip rather shorter than in the type. Md. Nur's specimen is labelled "flowers white with red in centre." If this is accurate, this variety may be a distinct species. Further material is needed.

SPECIMENS. *Perak.* G. Kerbau, 4,000 feet, Robinson s.n. June 1913; Haniff 3954. *Kelantan.* G. Sitong, S.F.N. 12179 (Md. Nur). *Kedah.* Kedah Peak, Ridley s.n. June 1893.

5. **Alpinia javanica** Bl., Enum. Pl. Jav. 59. 1830. Ridl., Flora 4: 283. *A. involucrata* Griff. Notul. 3: 422. 1851. *Costus malaccensis* Koenig, Retz. Obs. 3: 71.

1791. *Alpinia campanaria* Ridl., J.S.B.R.A.S. 86: 308. 1922. Flora 4: 283. *Languas javanica* Burk., Kew Bull. 1935: 318.

Stems close together, about 2–3 m. tall, swollen at base and greenish or brownish. *Leaves* to about 90 by 15 cm., light green, distinctly ribbed, short-hairy beneath and in the groove of the midrib above, apex shortly caudate, base unequally cuneate; petiole to 10 cm. long, short-hairy; ligule to 2·5 cm. long, fringed with hairs, bilobed; sheath densely hairy near base of petiole and ligule. *Inflorescence* erect or more or less drooping, to about 20 cm. long, protected when young by 2 or 3 very broad rather short sheaths, to about 12 by 4 cm. *Rachis* with short appressed hairs, bearing up to about 12 cincinni. *Primary bracts* broad, round, 1 cm. or less long near base of inflorescence, much longer towards apex, white turning brown. *Stalks of cincinni* variable, the longest 2 to 6 cm. long, drooping, short-hairy: about 3–6 flowers in each cincinnus. *Secondary bracts* broadly cup-shaped, white or pinkish, the mouth 2–3 cm. across, edge to base to about 2 cm., hairy at base and near edges. *Pedicels* of flowers to about 5 mm. long, hairy. *Calyx* with ovary about 2·2 cm. long, funnel-shaped, the edges slightly lobed, the ovary 4 mm. long, densely hairy, calyx nearly glabrous, white tipped with pink. *Corolla-tube* a little shorter than calyx; lobes white, hairy outside towards the base, with thin edges; dorsal lobe to about 2·5 by 1·7 cm., the apex strongly hooded, lateral lobes nearly as wide, less strongly concave. *Lip* 4–5 cm. long, broadly obovate when flattened, the basal part funnel-shaped, the distal part spreading to a broad oblique circular mouth with crinkled edges, the basal part orange with red spots and stripes, a broad marginal band white. *Staminodes* red, up to about 8 mm. long, of irregular shape, with 2 or 3 points. *Filament* white, about 1 cm. long, anther massive 8 mm. long, without any crest, cream with a few red spots. *Fruit* spherical, about 2·5 cm. diameter, green, very short-hairy towards base and apex, crowned with persistent calyx: seeds said to be edible.

var. **colorata** Ridl. Bracts, calyx, and tips of petals rose-red, the petals paler than the calyx, white at the base.

This species has been found at many localities in all parts of Malaya, in the lowlands, in open places in forest. It is distinctly variable in the size of the inflorescence and the length of the stalks of the cincinni. The colour of the flowers seems to be constant except for the var. *colorata* which has been found only in the Kinta Valley of Perak.

The local names recorded for *A. javanica* are Gingin, Puar Puteh and Tepus Puteh; Mr. Corner records Lĕngkĕnang as a well-known name for it near Kuala Kangsar.

Distribution: Java and Sumatra.

6. **Alpinia pahangensis** Ridl., Flora Mal. Pen. 4: 282. 1924. *Alpinia Burkillii* Hend., Gard. Bull. S.S. 4: 55. 1927. *Languas pahangensis* Hend., Gard. Bull. S.S. 7: 125. 1933.

Stems 2–3 m. tall. *Leaves* to about 75 by 13 cm., light green, short-hairy both above and below, the hairs on upper surface very fine with swollen bases, apex shortly caudate

(cauda to 3 cm.), base unequal, cuneate; petiole to 3·5 cm. long, hairy; ligule yellowish, to 1 cm. long, more or less bilobed, fringed with hairs nearly 2 mm. long; sheath with long hairs on edges and short hairs on surface, at least near petioles. *Inflorescence* 20–30 cm. long, with a long sheath at the base. *Rachis* stout, densely short-hairy, bearing 20–25 cincinni, each with 2–7 flowers. *Primary bracts* at base of inflorescence very short, fringed with long hairs, towards apex of inflorescence much longer, the highest ones sometimes as long as flowering bracts. *Stalks* of cincinni velvet-hairy, commonly to 1 cm. long, at bases of large inflorescences sometimes to 2·5 cm. long. *Secondary bracts* narrowly funnel-shaped, obliquely truncate, thin and papery, short-hairy or nearly glabrous on outer surface, fringed with rather long hairs, the outer ones commonly 2 cm., sometimes to 3 cm. long, cream. *Pedicels* of flowers to 2 cm. long, hairy. *Ovary* covered with spreading stiff hairs. *Calyx* with ovary c. 2 cm. long, tubular, not deeply split, white, lobes almost equal, hairy, one or two of them with slender points up to 3 mm. long. *Corolla-tube* a little shorter than calyx, slender; lobes densely hairy, cream; dorsal lobe at right angles to lip, 2 cm. long, 9 mm. wide near base, the apex strongly concave and produced on the back to a pointed spur; laterals 7 mm. wide, concave towards their tips, close beneath the lip but diverging. *Labellum* white with two large patches of dull red-purple on the side lobes (not or only in part reaching the edge) and deep violet-purple lines down the median band and into the midlobe; base cuneate, widening rather abruptly to a nearly semi-circular but distinctly 3-lobed blade, the lobes nearly equal, and the whole blade wide-spreading and shallowly concave; total length of lip 3 cm., width rather more than length. *Staminodes* at right angles to the edges of the base of the lip, in contact with the stamen, fleshy, dark purple, 2 mm. long and 2 mm. wide at base, the apex entire or 2-toothed. *Filament* curved towards lip, 1·2 cm. long; *anther* 7 mm. long and 4–5 mm. wide, with a petaloid crest 2–4 mm. long and 4–7 mm. wide, the crimson edges irregularly and rather deeply toothed.

The type of this species is not in Singapore, but it was seen by Henderson, who stated that it was identical with *A. Burkillii* Hend., from specimens of which the above description is made. This species is common in some parts of Pahang, at Kemaman (Trengganu), at Gemas, and N.W. Johore (in blukar) but not elsewhere in Malaya. It is nearly related to *A. Murdochii*, but is vegetatively larger, has larger flowers, and a crested anther. Ridley states that the anther is not crested, but it is so in Henderson's no. 25080, of which I have seen good alcohol material. Mr. Corner reports that the Kemaman plants were common in the swamps, the rhizome supported above ground on stilt-roots 5–20 cm. long.

SPECIMENS. *Pahang.* Pekan, Evans (type of species, not seen). Near Bukit Sagu, S.F.N. 25080 (Henderson). Sungei Luit, near Kuantan Road, S.F.N. 17310 (Burkill and Haniff). Between Sungei Lepar and S. Ketam, 126 mile, Kuantan Road, S.F.N. 19461 (Burkill and Haniff). *Negri Sembilan.* Gemas, S.F.N. 4980 (Burkill). *Trengganu.* S. Sisek, S. Nipa, Kemaman, S.F.N. 30537 (Corner).

7. **Alpinia Murdochii** Ridl., J.S.B.R.A.S. 44: 196. 1905. Flora 4: 280.

Rhizome at surface of ground, bearing aerial stems close together. *Stems* to 1·5 m. tall, sheaths green. *Leaves* commonly about 30 by 4–6 cm., exceptionally to 7 cm. wide; very shortly-hairy on both surfaces or sometimes almost glabrescent, apex acuminate and shortly caudate, base narrowly cuneate; *petiole* to about 7 mm. long (1·5 cm. on G. Tahan specimens), usually distinctly hairy; ligule 0·7–1·8 cm. long, fringed like the edge of the sheath with hairs c. 1 mm. long; surface of sheaths short-hairy or glabrescent. *Inflorescence* 10–15 cm. long beyond the highest leaf-sheath, covered when young by two hairy sheaths about 6 by 1·5 cm. *Rachis* densely hairy, hairs spreading, 1 mm. long; bearing up to about 25 short cincinni, each with 1–4 flowers. *Primary bracts* hairy, thin, deciduous, about 1·5 by 0·7 cm. *Stalks* of cincinni to 1 cm. or rather more on lowest ones (1·5 cm. on G. Tahan plants). *Secondary bracts* broadly funnel-shaped, thin, very hairy, apex obliquely truncate, longest side to about 1 cm. (G. Tahan plants to 1·5 cm.). *Pedicel* of flower to 5 mm. long; ovary short, densely hairy. *Calyx* with ovary c. 1·3–1·5 cm. long. *Corolla-tube* as long as calyx or a little longer; lobes sparsely hairy, about 1·5 cm. long, white, the dorsal one 7 mm. wide at base, strongly concave towards the apex, the concave part slightly produced upwards with a rounded hairy top, laterals a little narrower than dorsal, slightly concave towards the apex. *Labellum* about 2 cm. long, widening gradually from the base and in close contact with dorsal petal, obovate-3-lobed, the lobes almost equal, lateral ones truncate, middle one slightly cleft and bearing about 10 dark purple lines; rest of labellum white with some pale crimson mottling towards the base or a broad crimson border towards the base. *Staminodes* about 1 mm. long, rounded, fleshy. *Filament* 1·2 cm. long, curved towards the lip; anther 7–8 mm. long, cream with pink spots on the back, connective not produced at apex. *Fruit* orange-red, short-hairy, round, about 1·5 cm. diameter, with 2–4 seeds in each loculus.

This species has been collected several times at and near Fraser's Hill, where it is apparently fairly common, and also on G. Mengkuang Lebah. A fruiting specimen (Batten-Pooll s.n. December 1939) from Cameron Highlands may be this species. Ridley collected it also at 3,000 feet on G. Tahan. The latter specimens differ in having longer stalks and longer bracts to the cincinni, possibly rather larger flowers, with more hairy corolla-lobes. G. Tahan plants may perhaps rank as a local variety. The most remarkable thing about the Fraser's Hill plants is the great variation in length of ligule. Corner's two collections have both much longer ligules than any others, but in other characters seem to agree closely with other specimens. Ridley states that the dorsal corolla-lobe is "yellowish white, finely dotted red". Corner says no colour in any parts of flower except lip and anther.

SPECIMENS. *Selangor.* Semangkok Pass (= The Gap), Murdoch, February 1904 (Type), Curtis s.n. May 1902.

Sempang Mines, Ridley 12030 (= below Fraser's Hill, near the Gap). Semangkok Pass, S.F.N. 8868 (Burkill and Holttum). G. Mengkuang Lebah, 5,000 feet, Robinson s.n. January 1913. *Pahang.* Fraser's Hill, S.F.N. 8671 (Burkill and Holttum); S.F.N. 33156 (Corner); Corner s.n. 11.8.1937. G. Tahan, Wray's Camp, Ridley s.n. July 1911.

8. **Alpinia Seimundii** Ridl., J.S.B.R.A.S. 86: 309. 1922. Flora 4: 280.

There is no specimen ascribed to this species in Singapore. Ridley's descriptions are so inaccurate that it is hardly worth while repeating his information. Ridley states that the flowering bracts are tubular, and as regards size of plant and flowers Ridley's description would come near both *A. Murdochii* and *A. pahangensis*. The former is perhaps the more probable; *A. Murdochii* was collected at 3,000 feet on G. Tahan, quite near the type locality of *A. Seimundii* (Kuala Teku).

3. CATIMBIUM Jussieu

Inflorescence erect or ± drooping, bearing only cincinni of 1–3 flowers each, in some species the majority with only one flower. *Primary bracts* lacking, or so small as not to be evident, or rarely elongate near top of inflorescence. *Secondary bracts* usually large and broad, completely split to the base on the side towards the next flower, deciduous at or soon after flowering, at first completely enclosing the whole of the rest of the cincinnus, mainly white; in *C. muticum* rudimentary except towards apex of inflorescence. *Calyx* tubular but deeply split down one side (towards the lip) at flowering. *Corolla-tube* broad, shorter than the calyx; lobes long, white, the dorsal one very broad, not spurred near the apex. *Lip* large, more or less 3-lobed, the tip often bifid, entirely orange-yellow or yellow and crimson, usually elaborately marked. *Staminodes* when present slender, short, terete, awl or horn-shaped, often curving behind the filament of the stamen. *Anther* massive, the connective sometimes slightly prolonged at the apex but never into a thin crest. *Fruit* round or depressed-globose, orange, more or less hairy, 1·5–2·5 cm. diameter, containing many seeds.

The genus Catimbium was founded by de Jussieu in 1789, but he described no species. It was not recognized by any later botanist until Lestiboudois in 1841 published the names *C. nutans* Juss. ex Lestib. and *C. erectum* Juss. ex Lestib., from which we may presume that de Jussieu would have included *Alpinia nutans* in his genus. Horaninov used the name Catimbium for a section of Alpinia, including in it *A. nutans* and *A. malaccensis*, both of which had been well described and illustrated; he also included *A. javanica* Bl.,

which does not belong to this group, doubtless because Blume had only given a brief and unsatisfactory description.

Catimbium is a very natural group, no doubt related to Alpinia (as here limited), but very distinct in both bracts and flowers. In its deciduous, not funnel-shaped secondary bracts, it is nearer to Languas than to Alpinia. In nearly all species the secondary bracts are large, broad, concave, acute, completely enclosing the whole of the cincinnus which is beyond them until the next flower-bud is nearly ready to open. The one exception is *C. muticum*, which has rather small flowering-bracts (on basal cincinni none at all) for which reason Schumann included it in a separate subgenus (Probolocalyx), where however he accompanied it by some very remotely related species. The aspect of the flower is so close to that of other species of Catimbium that it is certainly nearly related to them. *A. muticum* also has consistently three flowers in each cincinnus, whereas other species mostly have not more than two; in this character it is primitive, and perhaps in the bract-character also.

KEY TO MALAYAN SPECIES OF CATIMBIUM

Secondary bracts falling before flowers open, not enclosing flower-buds, sometimes absent from lower cincinni; 2–3 flowers in nearly all cincinni 1. *C. muticum.*

Secondary bracts persistent, falling after flowering, enclosing buds to a late stage; usually 1–2 flowers in a cincinnus

- Secondary bracts about 2·5 cm. long; lip to 3·5 cm. long
  - Inflorescence erect, secondary bracts and calyx entirely white, lip orange-yellow with crimson marks 2. *C. assimile.*
  - Inflorescence drooping, secondary bracts tipped with pink; lip crimson with yellow markings at the base, edge yellow 3. *C. speciosum.*
- Secondary bracts 3–4 cm. long; lip more than 3·5 cm. long
  - Lip to 4·5 cm. long, orange-yellow with rather fine crimson lines and spots; mouth of tube in base of lip not prominent; leaves almost glabrous beneath, to 12 cm. wide 4. *C. latilabre.*
  - Lip to 6 cm. long, the inner parts crimson spotted with yellow; mouth of tube in base of lip prominent; leaves velvet-hairy beneath, to 20 cm. wide 5. *C. malaccense.*

1. **Catimbium muticum** (Roxb.) Holtt., **comb. nov.** *Alpinia mutica* Roxb., Asiat. Res. 11: 354. 1800. Fl. Ind. 1: 67. Roscoe, Monandr. Pl., t. 69. K. Schum., Pflanzr.

Zingib. 327. Ridl., J.S.B.R.A.S. 32: 165. 1899. Flora 4: 279. Valet., Ic. Bog. 2: t. 191. *Languas mutica* Degener, Fl. Hawaii Fam. 76. 1932. **Fig. 17.**

Stems about 1·2–1·7 m. tall, rather close together. *Leaves* glabrous except for hairy edges and apex and sometimes a few hairs on base of midrib beneath; blade to about 50 by 5 cm., midrib broadly grooved and pale above, apex gradually narrowed and then abruptly caudate (cauda to 3 cm. long), base narrowly cuneate; petiole to about 2 cm. long; ligule 7–8 mm., glabrous or fringed with hairs; sheaths green or purple-flecked, glabrous. *Inflorescence* to about 15 cm. long, emerging from uppermost leaf-sheath, the ligule of which is above the lower branches: rachis densely short-hairy; flowering branches to about 12, each bearing 2 or 3 flowers. *Primary bracts* none: stalks of flowering branches to about 5 mm., hairy. *Secondary bracts* soon falling, in base of inflorescence rudimentary or apparently lacking, the largest 5–15 mm. long present on upper cincinni only. *Pedicel* c. 5 mm. long, hairy. *Ovary* densely hairy, to 5 mm. long at flowering. *Calyx* c. 1·7–2 cm. long, funnel-shaped, with three short, hairy, toothed lobes, otherwise sparsely hairy, white, split deeply at flowering. *Corolla-tube* shorter than calyx: lobes white, sparsely hairy on backs, 2·5 to 3·0 cm. long, the dorsal one 2 cm. wide, laterals 1·5 cm. wide. *Labellum* 3 to 3·5 cm. long, broadly ovate, somewhat trilobed, the basal part strongly concave, the apical lobe pointing straight forwards, its edges crinkled, rounded or more or less bilobed; whole lip yellow, densely spotted with crimson in basal half except for yellow edges, the apical part veined with crimson; a swollen warty but not hairy area on each side of the base close to the stamen; entrance to mouth of tube narrow, closed with hairs, not prominent. *No staminodes. Stamen* as long as corolla-lobes; filament narrow, white, partly flushed with pink; anther 12 mm. long, without a crest, slightly yellowish, densely papillose on the pollen-sacs. *Fruit* round, orange-red, 1·5–2·0 cm. diameter, rather sparsely short-hairy, with remains of calyx at apex, not dehiscent but breaking under pressure into 3 parts: seeds about 8 in each loculus, covered with thin fleshy white aril.

This species was described by Roxburgh from plants grown at Calcutta, introduced there from Penang. It has been found in Kedah, Penang, Province Wellesley, Perak, Pahang, Johore and Singapore, especially near villages, in open places by ditches and streams. Valeton also reports it as occurring in Borneo. It seems to be little used, either as a spice or medicine, and has no well-established local name.

Gagnepain describes plants from Saigon as this species; but he says the primary bracts are 6 mm. long and the bracteoles 15–18 mm., the flowers somewhat smaller, with filiform staminodes sometimes present. The Saigon plants perhaps constitute a northern variety of *C. muticum.*

The size and number of the bracteoles (secondary bracts) varies much even on different inflorescences of the same plant. On small inflorescences there is often only

one bracteole, on the highest cincinnus; on large inflorescences there are several on upper cincinni (only one to each cincinnus), but always the lower cincinni quite lack bracteoles.

2. **Catimbium assimile** (Ridl.) Holtt., **comb. nov.** *Alpinia assimilis* Ridl., J.S.B.R.A.S. 32: 166. 1899. Flora 4: 280.

Allied to *A. latilabris* Ridl., differing in: somewhat smaller vegetative size; more glabrous leaves; rachis of inflorescence to about 15 cm. long; secondary bracts entirely white, to 2·5 cm. long; calyx quite white, excluding ovary about 1·8 cm. long; dorsal corolla-lobe to about 3 by 1·6 cm.; lip to about 3·2 cm. long and wide, the crimson marking stronger, the warty swellings at the base smaller, the staminodes usually absent; fruit nearly as in *A. mutica*, spherical, deep orange, the hairs short, not stiffly spreading.

Ridley described this species from plants obtained near Pekan, Pahang, in 1891; there are plants in the Botanic Gardens, Singapore, which agree with his description and specimens. Ridley ascribed to his species the plant from Borneo illustrated by Hooker in the Bot. Mag., t. 6908 (as *A. mutica*); but, as pointed out elsewhere, this figure of Hooker's agrees rather with Ridley's *A. latilabris*.

There is no doubt that *C. assimile* is intermediate between *C. muticum* and *C. latilabre*. It was found in the same district as the only Malayan specimens of *C. latilabre*, and may well be a hybrid between that species and the common *C. muticum*. Though Ridley correctly pointed out that *C. assimile* differs from *C. muticum* in its large white bracts which quite envelop the flower-buds until just before flowering, he referred to it several specimens which are certainly *C. muticum*, having quite small bracts.

SPECIMENS. *Pahang*. Pekan, Pao Seolah Kayu, Ridley 126. Ayer Eatem, Ridley 1218 (or 218?).

3. **Catimbium speciosum** (Wendl.) Holtt., **comb. nov.** *Zerumbet speciosum* Wendl., Sert. Hann. t. 19. 1798. *Renealmia nutans* Andr., Bot. Rep. 5: t. 360. c. 1800. *Alpinia nutans* Rosc. in Smith, Exot. Bot. 2: t. 106. 1805. Monandr. Pl. t. 73. 1828. Bot. Mag. t. 1903. Roxb., Fl. Ind. 1: 65. Ridl., Flora 4: 277. *Languas speciosa* Small, Fl. S.E.U.S.A. ed. 2, 307. 1913.

Stems to 2 m. tall. *Leaves* to 50 by 8 cm. or more, edges hairy, midrib below hairy and sometimes whole lower surface also, tip shortly pointed, base narrowly cuneate; petiole to 2·5 cm. long, hairy; ligule to 1·2 cm. long, hairy; sheath near blade hairy. *Inflorescence* to about 20 cm. long, decurved or drooping, when young protected by 2 long sheaths. *Rachis* densely short-hairy, bearing 25 or more cincinni of usually 2 flowers each. *Primary bracts* absent. *Secondary bracts* about 2·5 cm. long, broad, white, pink-tipped. *Ovary* at flowering densely hairy, c. 6 mm. long. *Calyx* excluding ovary 2

cm. long, glabrous except at tips of lobes. *Corolla-tube* shorter than calyx; lobes white, about 2·5 cm. long, the dorsal one much broader than the others, edges only hairy. *Lip* about 3·5 cm. long, shaped and coloured as in *C. malaccense* but less deeply lobed. *Staminodes* to 8 mm. long, very narrow. *Stamen* as in *C. malaccense*. *Fruit* in Malayan plants not seen; said to be round, orange, 2 cm. diameter, slightly hairy.

This species is considered to be native in N.E. India, Burma and Indo-China. Ridley stated that it is not native in Malaya, but sometimes cultivated. The two specimens quoted below, collected (apparently wild) in extreme northern Malaya, are either *C. speciosum* or near it; they might be *C. malaccense*, but are much smaller than var. *nobilis* and also have paired flowers almost throughout, as described for *Alpinia nutans*. Haniff's colour notes agree with *C. malaccense*. Ridley referred the Perlis specimen to *C. latilabre*, but it is smaller, and has paired flowers throughout.

SPECIMENS. *Perlis*. Base of Bukit Lagi, Ridley 14776. *Kelantan*. Kuala Pertang, S.F.N. 10363 (Haniff and Nur).

4. **Catimbium latilabre** (Ridl.) Holtt., **comb. nov.** *Alpinia latilabris* Ridl., J.S.B.R.A.S. 32: 168. 1899. Flora 4: 282. *A. mutica* quoad Hk. fil. Bot. Mag. t. 6908 (non Roxb.). *A. Hookeriana* Valet., Bull. Inst. Bot. Buitenz. 20: 81. 1904. Ic. Bog. 2: t. 189. 1906. **Fig. 18.**

Stems to 3 m. tall (possibly even taller). *Leaves* to about 60 by 12 cm., narrowed gradually to the short reflexed caudate apex (2·5 cm. long), base narrowly cuneate, edges and apex hairy and sometimes the midrib beneath; petiole to 2·5 cm. long, short-hairy beneath; ligule broad, to 1·2 cm. long, short-hairy all over outer surface; sheath green, short-hairy towards petiole. *Inflorescence* to about 20 cm. long from lowest flowers to apex, protected when young by two long sheaths above the uppermost leaf, the lowest cincinni in the axils of these sheaths. *Rachis* stout, pale green, densely short-hairy, bearing up to 20–25 cincinni, each of one or two flowers only (about half are 1-flowered). *Primary bracts* lacking, or sometimes long ones present near top of inflorescence. *Stalks of cincinni* 6–10 mm. long, hairy. *Secondary bracts* 3–3·5 cm. long, broad, white with red flush towards apex (and sometimes at base also), completely enveloping both buds if two are present, the apex short-pointed and hairy; bract of second flower smaller. *Pedicel* of flower (beyond bract) 1–2 mm. *Ovary* densely hairy, 5–6 mm. long at flowering. *Calyx* white, pink towards the apex, 2–2·5 cm. long above the ovary, sparsely hairy on the back, more densely on the 3 short broad mucronate lobes, split more than half way down on the side towards the labellum. *Corolla-tube* about 1 cm. long; lobes white, the dorsal one 3·2 by 1·8 to 3·8 by 2·5 cm., laterals a little shorter, to 16 cm. wide; dorsal lobe with the lip forming a funnel-shaped flower, laterals close together beneath the lip. *Labellum* 3·5–4·5 cm. long and wide, broadly ovate and strongly concave, slightly 3-lobed, the side-lobes very broad and rounded, the midlobe pointing straight forwards, about 1·5 cm. wide and 1·2 cm. long, crinkled and somewhat retuse, the whole labellum

rich yellow, with fine close crimson spots on the basal part and on the side-lobes, and radiating crimson stripes on the midlobe and outer part of the side-lobes, the edges clear yellow; at the base two rather large fleshy swellings covered with dark crimson warts and short hairs on either side of the base of the stamen. *Staminodes* 2–3 mm. long, pinkish, hairy, at junction of lip and stamen, often unequally developed; sometimes lacking? (see *C. assimile*). *Filament* 1·3 cm. long, pink at the base; anther 1·2 cm. long, pale yellowish ± flushed with pink; connective somewhat produced beyond the anther, and more or less 2-lobed, yellow, sometimes spotted with red. *Stylodes* 3 mm. long, not enclosing base of style, massive, irregularly lobed. *Fruit* orange, depressed-globose, 2–2·5 cm. diameter, with many rather stiff spreading hairs, splitting only under pressure as in *C. muticum*.

This species was described by Ridley in 1899, from cultivated plants; he also quoted a specimen collected in Pahang which he said was identical. He did not notice however that his description agreed quite well with Hooker's *A. mutica* as figured in the Bot. Mag. t. 6908; he referred Hooker's plant to *A. assimilis* Ridl. Valeton, in 1904, described and figured *A. Hookeriana*, which he considered identical with Hooker's plant, and noted some discrepancies as compared with *A. assimilis* Ridl. Both Valeton's and Hooker's plants originated in Borneo.

There are in the Botanic Gardens, Singapore, two large clumps of plants agreeing very closely with Valeton's description of *A. Hookeriana* and with Ridley's of *A. latilabris*; the above description is taken from these plants. One clump differs from Valeton's description only in having the floral bracts white at the base; both Valeton and Hooker describe them as flushed with red at both base and apex. The second clump has slightlv smaller flowers than the first (lip to 4 cm. long), bracts pink at the base and a slight bilobed crest to the anther spotted red. *A. assimilis* Ridl. differs, as noted by Valeton, in having quite white bracts and calyx and in having smaller flowers. The Pahang plant referred by Ridley to *A. latilabris* differs in being taller than the Gardens plants (Ridley says 12 feet; the Gardens plants are not over 8 feet) and broader leaves (to 12 as against 9 cm.), somewhat hairy beneath. One of the Gardens clumps sometimes (not always) has long primary bracts near the top of the inflorescence.

Ridley compared *A. latilabris* to *A. nobilis*; but his description of the colour of the lip differs very much from that of *A. nobilis*, which is red with yellow spots, *A. latilabris* yellow with red spots. There seems little doubt that *A. nobilis* is closely allied to, and probably a local variety of, *A. malaccensis*.

SPECIMENS. *Pahang*. Pulau Datu, Ridley s.n. August 1891. Pulau Rumput, Ridl. s.n. 1891. (Both localities near Pekan).

5. **Catimbium malaccense** (Burm.) Holtt., **comb. nov.** *Maranta malaccensis* Burm. Fl. Ind. 2. 1768. *Galanga malaccensis* Rumph., Herb. Ambon. 5: 176, t. 71, f. 1. *Languas malaccensis* Merr., Philip. Jour. Sci. 19: 343. 1921. *Alpinia malaccensis* Rosc., Trans. Linn. Soc. 8: 345. 1808. Bot. Reg. t. 328. Gagnep. Fl. Gen. Indoch. 6: 96. Valet., Bull. Inst. Bot. Buit. 20: 76.

var. **nobilis** (Ridl.) Holtt., **stat. nov.** *Alpinia nobilis* Ridl., J.S.B.R.A.S. 32: 169. 1899. Flora 4: 282.

Stems 2–4 m. tall (Ridley). *Leaves* to about 90 by 20 cm., short velvet-hairy beneath and in groove of midrib above; apex shortly pointed, base narrowly cuneate, unequal; petiole to about 3 cm. long, hairy; ligule hairy, to 1·5 cm. long, sometimes 2-lobed; sheath densely short-hairy near the blade. *Inflorescence* to about 35 cm. long from lowest flower to apex, protected when young by 2 long sheaths which are attached just below the flowers. *Rachis* erect, stout, densely hairy, green, bearing 60 or more single flowers; a few basal branches with 2 flowers. *Primary bracts* absent: stalks below flowering bracts 1 cm. long, densely hairy. *Secondary bracts* 4·2 cm. long, white (tipped with red ?), very broad, short-hairy. *Ovary* at flowering densely hairy, c. 9 mm. long and 1·2 cm. wide. *Calyx* about 3·2 cm. long, shortly 3-toothed, deeply split, densely short-hairy, white tipped with pink. *Corolla-tube* 1·2 cm. long; lobes white, very hairy on their backs; dorsal lobe to 4 by 2·5 cm., laterals a little shorter, 1·5 cm. wide. *Labellum* 6 cm. long, broadly ovate with a projecting rather deeply bifid apical part, the edges strongly crinkled, the inner parts crimson, spotted with yellow, the edge paler yellow mottled with pale purple, the bifid apical part a brighter yellow with red stripes: at base of lip the mouth of the tube of the flower, laterally compressed to a slit-like opening, covered with hairs, projects somewhat, and extends from the filament to the midrib of the lip, about 8 mm., and on either side of it is a small swelling. *Staminodes* horn-like, curved behind the anther, to 5 mm. long, sometimes absent. *Stamen* cream-white, filament nearly 2 cm. long, slightly speckled with pink; anther massive, 1·2 cm. long, the connective not prolonged at the apex. *Style* and stigma white, stigma curved upwards, hairy. *Fruit* depressed-globose, orange, with stiff spreading hairs 2 mm. long and shorter hairs also.

This species is ultimately based on *Galanga malaccensis* Rumph., for Burmann gives only a couple of lines of description and quotes Rumphius, who gives sufficient details to characterize the plant reasonably well. Burkill (Dictionary 2: 1310) includes *Alpinia nobilis* Ridl. as a synonym of *A. malaccensis*. There is no doubt that the plant in cultivation in Singapore (doubtless the same which Ridley described) agrees in essential details with the Java plant described by Valeton under the name *malaccensis*. Valeton however does not give dimensions. Roxburgh describes the lip as even longer than in Malayan plants; on the other hand, Gagnepain describes the flowers as much smaller. In the absence of further information, I think

the Peninsula plant, represented by the specimens quoted below, might rank as a local variety, var. *nobilis* (Ridl.). It has the largest flowers of any Malayan Catimbium. It is no doubt related to *C. latilabre*, but has the lip mainly red mottled with yellow, instead of yellow mottled with red, and (as Valeton notes) the prominent end of the flower-tube in the throat of the lip is characteristic. It has much larger more hairy leaves than *C. latilabre*. The distribution appears to be N.E. India to Indo-China, southwards to Malaya and Java.

SPECIMENS. *Pahang.* Kuala Tembeling, Ridley s.n. 1891. *Selangor.* Ginting Bidai, Ridley 7795. *Cult. in H.B. Singap.* Ridley 4617; S.F.N. 32516 (Corner).

4. LANGUAS KOENIG

Inflorescence bearing lateral cincinni, the rachis sometimes bearing also one or more branches at the base, the branches bearing cincinni like the main rachis; the whole inflorescence enclosed in a few long sheaths until the flowers are about ready to open. *Primary bracts* usually small, often longer towards apex of inflorescence. *Secondary bracts* small, of comparable size to the primary bracts, not sheathing at the base, the first one never surrounding the pedicel of the first flower. *Flowers* rather small. *Calyx* tubular, not deeply split. *Lip* not much longer than corolla-lobes, usually deeply cleft, white and pink-purple. *Staminodes* small, triangular, tooth-like, at base of lip. *Anther* with or without a small crest. *Fruit* c. 1 cm. diameter, round, red or black, containing few seeds, sometimes imperfectly 3-locular, the seeds attached to the dissepiments near the outer wall.

This genus dates from 1783, and (as noted on p. 129) is the first proposed for any species of the genus Alpinia as understood by Schumann. The species described by Koenig were *L. vulgare* (=*Alpinia galanga* (L.) Sw.), *L. chinensis* (a doubtful species, described from cultivated plants, perhaps at Malacca; Burkill suggests that it is *L. melanocarpa*, but this is not sure) and *L. aquatica* (an Indian species of Catimbium in the sense here used for that genus). It has been generally agreed to typify the genus on *L. vulgare* = *L. galanga*, which is a species much cultivated and used for food and medicine in Malaysia.

The species all have rather small flowers. The inflorescence has usually well-developed cincinni carried by the main rachis, and also a few branch-rachises which carrry similar cincinni; but in *A. nieuwenhuizii* Valet. (Ic. Bog. 2: t. 192) the cincinni have at most two flowers. This species has also rather larger flowers than the Malayan ones, with

the lip only retuse, not deeply cleft, and has much larger fruits, though of similar structure.

The bracts are small (sometimes very small), never funnel-shaped nor large and hood-like. The fruit is usually small, and always has few seeds. The dissepiments separating the 3 loculi of the fruit are often imperfectly developed, so that the full-grown fruit is not 3-chambered, and the few large seeds are attached to the dissepiments, often near the ovary wall, not in an axile position as normal in allied genera. The seeds have a thin aril.

There are only three Malayan species, including the cultivated *A. galanga*, which is doubtfully wild in this country. The other two species are common and well-known, both occurring also outside Malaya.

KEY TO MALAYAN SPECIES OF LANGUAS

Secondary bracts about 1 cm. long; fruit red
1. *L. galanga.*

Secondary bracts under 1 mm. long; fruit black
Inflorescence usually with 2 or 3 large basal branches, the whole 30–40 cm. long; calyx 5 mm. long; corolla-lobes 10 mm. long; lip white 2. *L. scabra.*
Inflorescence sometimes with 1 large basal branch, the whole about 15 cm. long; calyx 8–9 mm. long; corolla-lobes 6–7 mm. long; lip pink or purplish towards the base 3. *L. melanocarpa.*

1. **Languas galanga** (L.) Stuntz, U.S. Dept. Agr. Bull. 261: 21. 1912. *Maranta galanga* Linn. Spec. Pl. ed. 2: 2. 1762. *Alpinia galanga* Sw., Obs. Bot. 8: 1791. Ridl., J.S.B.R.A.S. 32: 163. 1899. Flora 4: 279. *Languas vulgare* Koenig, Retz. Obs. 3: 64. 1783.

Stems closely tufted, to 2 m. or rather more tall. *Leaves* to about 50 by 9 cm., glabrous except for short-hairy base of midrib beneath and sometimes the edges towards the apex; apex very shortly pointed, base cuneate; petiole about 5–7 mm. long, more or less hairy beneath; ligule to 7 mm. long, short-hairy, and adjacent part of sheath also. *Peduncle* of inflorescence 7 cm. or more beyond the highest leaf-sheath, glabrous. *Rachis* to 25 cm. long, minutely hairy, pale green, bearing very numerous cincinni each bearing 3–5 flowers and about 2 cm. long (without flowers); basal cincinni sometimes in axils of long sheaths. *Primary bracts* very variable, apparently soon deciduous, at apex of inflorescence equal to the flowering bracts, on lower branches shorter or quite lacking, white. *Stalks* of cincinni 0·2 to 1·0 cm. long, short-hairy. *Secondary bracts* about 1–1·2 cm. long, rather narrow, enclosing the bud only when very young, white. *Pedicel* about 5–7 mm. long, short-hairy, pale green. *Ovary* at flowering c. 3 mm. long, ellipsoid, glabrous, green. *Calyx* c. 1·2 cm. long, nearly 5 mm. wide, cylindric, shortly and very broadly lobed, hairy on upper edge only, white or pale greenish. *Corolla-tube* about

as long as calyx; lobes pale green, white at tips, c. 2·0 cm. long, dorsal c. 8 mm. wide, concave at apex, hooded, laterals narower, spreading. *Lip* 2·5 cm. long, white with a few short oblique pink lines each side of midrib, basal third narrow, greenish, blade 1·3 cm. wide elliptic, concave, cleft about 6 mm. at the tip, the edges irregularly toothed. *Staminodes* at base of labellum, usually as rather broad teeth little over 3 mm. long, sometimes narrow, fleshy, terete, acute, up to 5 mm. long, reddish. *Filament* 1·3 cm. long, narrow; anther 9 mm. long, massive, yellow, without crest. *Fruit* red, smooth, c. 1 cm. diameter, spherical, containing few seeds. *Stylodes* very short and fleshy (c. 3 mm. long), irregularly lobed, with broad rounded apices.

Malay names: Langkuas, Lĕngkuas, Lĕngkuas benar etc.: Greater or False Galanga.

Distribution: probably wild in India, Indo-China, Philippines, Java and Borneo; cultivated extensively in S.E. Asia and Malaysia; common in villages in Malaya and half-wild in old clearings. The cultivated plants probably include several races. How much variation occurs in the cultivated plants of Malaya has not been investigated. The rhizome is much used as a flavouring for foods, and also medicinally. In Singapore the plants flower rather rarely, after exceptional dry weather.

2. **Languas scabra** (Bl.) Burk., Gard. Bull. S.S. 6: 260. 1930. *Hellenia scabra* Bl., Enum. Pl. Jav. 1: 60. 1827. *Alpinia scabra* Bak., F.B.I. 6: 256. 1892. Ridl., J.S.B.R.A.S. 32: 164. 1899. Flora 4: 279.

Stems 2–3 m. tall when flowering. *Leaves* 40–50 by 6–9 cm., oblong, edges with scattered stiff hairs, apex rather shortly acuminate, base cuneate, lower surface short-hairy or sometimes almost glabrous; petiole to about 1 cm. long; ligule to 1 cm. long, short-hairy or glabrescent. *Inflorescence* 30–40 cm. or more long, usually with 2 or 3 large branches (to 15 cm. long) in the lower part, the branches in the axils of long sheaths; apical portion, bearing short cincinni only, 20–30 cm. long; rachis rather stout, short-hairy or almost glabrous. *Primary bracts* towards base of inflorescence very small; towards apex up to 8 mm. long. *Stalks* of cincinni 1–2·5 cm. long; up to 6 flowers on each. *Secondary bracts* about 1 mm. long. *Pedicel* slender, about 5 mm. long: ovary at flowering about 1 mm. long. *Calyx* 5 mm. long, broadly, tubular, white, unequally 3-lobed, tips of lobes shortly pointed, hairy. *Corolla-tube* slender, 8 mm. long; lobes about 10 mm. long, white. *Labellum* shorter than the corolla-lobes, white, cleft almost to the base, the two halves bilobed with narrow apical and wider lateral lobe. *Filament* elongating to nearly 1 cm.; anther 5 mm. long with a small crest. *Staminodes* hardly 1 mm. long, tooth-like, at base of lip. *Fruit* round, smooth, black, 10–12 mm. diameter, containing few seeds.

Malay name: Lĕngkuas Raya.

Distribution: Java (probably Sumatra also) and Malaya.

This large species is closely allied to *A. galanga*, but has larger inflorescences, much smaller flowering bracts,

smaller flowers differing in various details and a black fruit. It is common at moderate elevations (1,000–3,000 feet) on mountains in all parts of Malaya, and in the lowlands in N. Johore at least, and has been collected many times. Ridley describes the lip as bifid, the lobes narrow; but in the specimen examined by me the lobes are bilobed, much as in *A. melanocarpa*, but the median cleft much deeper.

3. **Languas melanocarpa** (T. et B.) Burk., Gard. Bull. S.S. 6: 260. 1930. *Hellenia melanocarpa* T. et B., Nat. Tijdschr. Ned. Ind. 24: 328. 1862. *Alpinia melanocarpa* Ridl., J.S.B.R.A.S. 32: 163. 1899. Flora 4: 279. Valet. in lc. Bog. 2: t. 190. 1906. ? *A. Fraseriana* Oliv., Hk. Ic. Pl. t. 1567. 1877.

Rhizome 1 cm. or more thick, 15 cm. or more between aerial shoots. *Stems* at flowering to nearly 2 m. tall; sheaths glabrous. *Leaves* to 30 by 5 cm., glabrous, apex shortly acuminate, base rather broadly and abruptly cuneate, edges with very small narrow teeth; petiole 5–10 mm. long; ligule to 6 mm. *Peduncle* slender, glabrous, about 7–10 cm. beyond the highest leaf-sheath, sometimes with a single main lateral branch. *Rachis* usually about 15 cm. long, bearing many short cincinni up to 1·5 cm. long (without flowers), glabrous. *Primary bracts* barely 0·5 mm. long, soon disappearing. *Stalks* of cincinni to about 3 mm. long. *Secondary bracts* smaller than primary bracts. *Pedicel* of flower about 5 mm. long, glabrous. *Ovary* glabrous, narrowly ovoid, 1·5 mm. long. *Calyx* rather narrowly tubular, 8–9 mm. long, glabrous, unevenly 3-toothed. *Corolla-tube* glabrous, 2–3 mm. longer than calyx, white; lobes white, 6–7 mm. long, the dorsal nearly as wide as long, the laterals narrower, white or pale pink. *Labellum* a little longer than the corolla-lobes, the narrow base with a triangular tooth or lobe on each side (staminodes), the blade widening to about 5 mm., split from the apex about half-way to the base, the two halves unequally bilobed, pink or purplish towards the base. *Filament* slender c. 4 mm. long; anther 4 mm. long including a small round apical crest. *Fruit* black, round, c. 8–10 mm. diameter, containing 3–4 seeds.

Malay names: Langkuas Ranting; Měngkanan.
Distribution: Sumatra: Borneo?

This species is locally common near the sea, at least in the southern part of Malaya and the East Coast; many specimens have been collected. The Malayan specimens agree closely with Valeton's description and figure, apparently from a cultivated plant brought from Sumatra. Ridley says that the anther-crest is lacking, but it is clearly present in the specimens examined by me, and the lateral teeth at the base of the lip (staminodes) also agree with Valeton's figure. His floral dimensions are rather larger than those observed by me on dried specimens, but vegetatively Malayan plants are rather larger than Valeton's, the leaves and petioles a little longer. The peculiar teeth or

stiff hairs on the leaf-edges are distinct. Burkill suggests that this species is the same as *Languas chinensis* Koenig, cultivated about 1780 by Chinese at Malacca; but as the identity cannot be clearly established, it is better to ignore Koenig's name.

Alpinia Fraseriana Oliv. (Hk., Ic. Pl. t. 1567) from Borneo is similar, and Valeton suggests that it is probably conspecific with *A. melanocarpa*, in which case the species ranges to both Borneo and Sumatra.

5. PLAGIOSTACHYS Ridley

Rhizome at or just below ground-level, bearing leafy shoots fairly close together. *Leaf* shoots 1–3 m. tall, bearing short-stalked fairly large glabrous or hairy leaves, the ligule usually deeply bilobed. *Inflorescences* apical on the rather short stem of the leafy shoots, breaking through the leaf-sheaths and thus appearing to be lateral; usually with 1–4 lateral branches at the base of the main inflorescence; rachis stout, short-hairy, bearing single flowers very close together. *Primary* bracts lacking or rudimentary. *Flowering bracts* tubular or funnel-shaped, longer than the calyx, the apical part at least becoming mucilaginous and early decaying. *Pedicel* of flower beyond the bract 2–5 mm. long at fruiting; ovary small, glabrous or short-hairy. *Calyx* tubular or funnel-shaped, not deeply split, with three broad short lobes which at flowering become mucilaginous. *Corolla-tube* usually somewhat shorter than calyx; lobes subequal, the dorsal one erect and hooded at the apex, the laterals, below the lip, a little shorter and less concave near the tip. *Labellum* a little longer than corolla-lobes, more or less obovate, the sides little raised at the base, the apex spreading with a crinkled margin, more or less deeply cleft, colour yellow or pale yellow, with or without pinkish stripes, with 2 swollen areas at the base between the staminodes and the stamen. *Staminodes* short, narrowly triangular and acute or nearly oblong. *Stamen* suberect, about as long as the dorsal corolla-lobe, the anther with a small blunt triangular apical prolongation of the connective. *Stylodes* short. *Fruits* smooth, crowded, the wall thin and firm, apparently not dehiscing, 3-chambered, each loculus with 3–6 aromatic angled seeds closely packed together.

This genus was established by Ridley for a species which he had previously called *Amomum laterale*. He justly remarked that while Amomum was taken in a broad sense this species might reasonably be included in it, but with the breaking up of Amomum (in Baker's sense) a new genus was certainly needed for this species. Ridley

also suggested that perhaps Plagiostachys was nearer to Alpinia than to Amomum.

The structure of the inflorescence is very interesting. It is terminal on the leafy stem but pushes its way through the sides of the sheaths instead of to their apices as in Alpinia. The arrangement of bracts was not correctly described by Ridley. The flowering bracts are certainly tubular. I take them to correspond to the tubular bracteoles of Amomum; no genus of this alliance has tubular primary bracts. There is no evidence of the presence of primary bracts on herbarium specimens; perhaps rudiments may be found if young fresh inflorescences are examined.

The genus has in common with many species of Amomum the colour of its labellum; and also in common with some the mucilaginous degeneration of its bracts; and in common with others the thin-walled smooth indehiscent fruit with aromatic seeds. The species of Amomum which develop their flowers like Plagiostachys in a mass of decaying mucilaginous bracts are however those with spiny fruits. The branching of the inflorescence is remarkable, and unlike anything in Amomum.

On the whole, Plagiostachys seems fairly nearly allied to Amomum, and more remotely to Alpinia. It extends widely in the Malayan region, but the species have not been well described and their number is uncertain.

KEY TO THE MALAYAN SPECIES OF PLAGIOSTACHYS

Lip yellow without pink veins; inflorescence arising at 30 cm. or more above ground level

Leaves glabrous, to 10 cm. wide, sessile; bracts persisting and conspicuous at fruiting, the main veins remaining intact so that the edges appear irregularly long-toothed; fruiting heads 4 cm. through
1. *P. lateralis.*

Leaves hairy, to 25 cm. wide, stalked; bracts quite disintegrating except for a small cup-shaped base not visible at fruiting; fruiting heads 5 cm. through
2. *P. mucida.*

Lip cream with median yellow band bordered by pink stripes; inflorescence arising 5–10 cm. from ground level
3. *P. albiflora.*

1. **Plagiostachys lateralis** (Ridl.) Ridl., J.S.B.R.A.S. 32: 152. 1899. Flora 4: 273. *Amomum laterale* Ridl., Trans. Linn. Soc. 3: 381. 1893.

Stems about 2 m. tall. *Leaves* to about 75 by 10 cm., glabrous, apex more or less caudate (cauda to 4 cm. long), base narrowly cuneate; petiole none; ligule 5 mm. long, broad, not

lobed, fringed with hairs when young; sheath glabrous, purplish (?). *Inflorescence* produced at more than 30 cm. above ground level, simple or with a single shorter branch, the main rachis elongating to 15–20 cm., sessile at the point of emergence from the leaf-sheaths. *Bracts* persistent but from an early stage the ends partially rotted and reduced to the main veins only, tubular, about 1·5 cm. long, ribbed when dry, glabrous or nearly so. *Flower* sessile within the bract: ovary small, glabrous. *Calyx* with ovary about 1 cm. long or a little more, glabrous. *Corolla-lobes* dark red. *Lip* orange-yellow, emarginate. *Staminodes* short, acute, tooth-like. *Filament* pubescent, anther pubescent, white, 4 mm. long, with a small triangular prolongation of the connective at the apex. *Infructescence* compact, about 4 cm. diameter. *Fruit* sessile, surrounded by the persistent bracts, almost round with a short narrowed unequally 3-lobed apex (the calyx rotted away) about 1·2 cm. diameter, thin-walled, with 3 or 4 seeds in each cell, the seeds angled at the centre, with rounded peripheral sides as in Alpinia.

This species is characterized by its long, little branched inflorescence, persistent bracts, rather small pointed fruits, and glabrous sessile leaves with short ligules. The flower-colours are taken from Ridley, who however confused this species with *P. mucida*, so that there may be some error. *P. lateralis* has been found only in Singapore, Johore and Pahang. The height at which the inflorescence emerges has not been recorded accurately. In one place Ridley says 30 cm. above ground; in another, half-way up the stem.

Specimens. *Singapore.* Bukit Mandai, Ridley 4620. Chan Chu Kang, Ridley s.n. 1892. *Johore.* Batu Pahat, Ridley 11197 (p.p., the rest being *P. mucida*). Sungei Tebrau, Ridley 13230. Mt. Austin, Ridley s.n. May 1904. *Pahang.* Pulau Tawar, Kadondong, Ridley s.n. August 1891 (Type).

2. **Plagiostachys mucida** Holtt., **sp. nov.**

Caules foliati conferti, ad 300 cm. alti, folia infima 12–150 cm. supra terram ferentes basi ampliati et bulbiformes, parte bulbiforme 5–6 cm. diametro interdum rubicundo, vaginis suprabasalibus viride-lutescentibus; *lamina folli* ad 100 cm. longa et 25 cm. lata, subtus viridis (vel in costa lutescens) breviter et molliter pilosa, supra capillis brevissimis leviter aspera, apice breviter caudato-acuminata, basi anguste cuneata; *petiolus* molliter et breviter pilosus, 1–5 cm. longus; ligula biloba, ad 7 mm. longa, hirsuta; *vagina* breviter pilosa. *Inflorescentia* 30–40 cm. supra terram e tubo vaginarum emergens, ramosa, ramis 2–4 lateralibus pedunculis 2–4 cm. longis donatis, ramo terminale pedunculo 2–7 cm. longo donato; *pedunculi* ad 12 mm. diametro, dense et breviter hirsuti; *bracteae* flavescentes, tubiformes, in inflorescentia florifera jam marcescens et mucidae; in inflorescentia frugifera reliquiae bractearum parvae, cupuliformes, marginibus irregulariter laceratae; *pedicellus* floris brevissimus, pedicellus fructus c. 2 mm. longus; *ovarium* 2·5 mm. longum, glabrum; *calyx* cum ovario 12 mm. longus, lobis mucidis; *corollae* tubus quam calycem leviter brevior, lobi 8–9 mm. longi, 5 mm. lati, glabri, lobus dorsalis erectus, cucullatus, pallide pellucide roseus;

labellum luteum nitente, marginibus pallidioribus, quam lobos corollae leviter longius, fere planum, e basi sensim ampliatum, apice recurvatum et bilobatum, lobis bilobulatis, lobulis apicalibus divergentibus angustis acutis 2·5 mm. longis, lobulis lateralibus rotundatis; labellum basi utroque latere inter staminodia et filamentum tumidum et papillosum; *staminodia* pallide lutea, fere oblonga, c. 3 mm. longa, 1·5 mm. lata; *filamentum* pallide lutescens, 4 mm. longum; *anthera* 4 mm. longa, minute papillosa, crista rotundata haud 1 mm. longa; *stigma* pallide lutescens, marginibus solum ciliatum, supra cristam antherae leviter elevatum; *syncarpia* lateralia ad 7 cm. longa, terminale vulgo longiora, interdum ad 15 cm. longum, c. 5 cm. diametro, cylindrico-ellipsoidea, cupulis reliquiarum bractearum non manifestis; fructus conferti, interdum pressione multi-angulati, pyriformes, ad 2 cm. longi, apice plani vel late rotundati, apiculo haud prominente, lutei vel aurantiaci, pericarpium tenue et firmum; *semina* angulata aromatica, in loculo quoque 5–6. TYPUS: *Trengganu,* Kemaman, Ulu Bendong Swamp, 500 feet, S.F.N. 30271, leg. Corner 6.11.1935.

This species occurs in all parts of Malaya, from Singapore to Perak and Kelantan, chiefly in wet ground. It was confused by Ridley with *P. lateralis*, from which it differs in its more branched, conspicuously peduncled inflorescence, its mucilaginous bracts which are not strongly ribbed and almost disappear at fruiting, its larger less pointed fruits, its hairy leaves with conspicuous petioles. The details of the flower are lacking for *P. lateralis;* probably there are differences in the flower also.

It is possible that there exist two varieties of this species. Among the herbarium specimens, a few, including Corner's type, have partial inflorescences not more than 8 or 9 cm. long at fruiting; in these the individual fruits are closer, so that they compress each other unevenly and are angled; they also have a very broad apex, the tip sometimes apparently in a depression (this may be due merely to shrinkage on drying). Corner reports his fruits as turning yellow when collected. The majority of specimens have longer terminal inflorescences, with fruits not pressing each other, evenly rounded in section, the apex slightly prominent. The latter specimens also never have quite such long petioles. The only flowers seen (dried) match the type so far as observable.

The general aspect of the plants is near *P. borneensis*, but that species has hairy ovary and short-hairy fruit, and "red" flowers.

SPECIMENS. *Singapore.* Jungle behind Reservoir, Ridley s.n. 1893. Bukit Timah, near Cascade, Ridley 4411, 4412; Ridley s.n. May 1898. *Johore.* Batu Pahat, Ridley 11197 in part (the rest being *P. lateralis*). *Malacca.* Bukit Bruang, Ridley 3530. *Negri Sembilan.* Perhentian Tinggi, Ridley 9999. Bukit Sutu, Alvins 2060. G. Angsi, S.F.N. 9899 (Holttum). *Selangor.* Klang Water Catchment Forest, S.F.N. 7825, 9162

(Burkill). *Perak.* Taiping Hill, 200–300 feet, Henderson 10402. Tapah, S.F.N. 13457 (Burkill and Haniff). *Kelantan.* Sungei Tekal, near Gua Ninik, S.F.N. 19719 (Henderson). *Pahang.* Beserah, S.F.N. 16143 (Burkill and Haniff).

3. **Plagiostachys albiflora** Ridl., J.S.B.R.A.S. 50: 150. 1908. Flora 4: 273.

Leafy stems to 20 cm. apart, about 1·20 m. tall to top of tallest leaf-sheath, hardly swollen at base, the lower sheaths greenish, pinkish when young. *Leaves* dark green, lightly purplish beneath when young, to 70 by 16 cm.; glabrous, apex shortly acuminate, base gradually narrowed and decurrent on the petiole; petiole glabrous, 1–4 cm. long; ligule deeply bilobed, thin, glabrous or very short-hairy, 1–1·5 cm. long; sheaths glabrous or very short-hairy, flushed with purple, cancellately ribbed. *Inflorescence* emerging from sheaths at 5–10 cm. above ground level, short, simple or with a single lateral branch (rarely with 2 branches), the peduncle hardly projecting beyond the sheaths, or to 2 cm. long. *Bracts* whitish, disintegrating into mucilage at flowering, tubular to narrowly funnel-shaped, about 1·5 cm. long, strongly ribbed; at fruiting only the base remaining, sometimes with the remains of one or two ribs outstanding. *Ovary* 2 mm. long, glabrous. *Calyx* with ovary to about 1·4 cm. long, white, lobes broad, short, mucilaginous. *Corolla-tube* shorter than calyx; lobes 9–10 mm. long (dorsal longest), all 5 mm. wide at the base and concave at the apex, the dorsal one strongly concave, all white or pale translucent pinkish at the base with rose-pink tips. *Labellum* a little longer than corolla-lobes, obovate, nearly 1 cm. wide near apex, with a median groove from base to apex, the sides not much raised at the base, the edges crisped towards the apex, apex cleft less than 2 mm., with a short point on each side of the division; colour pale cream with a longitudinal yellow band edged with rose-pink and oblique lateral pink veins; a red swelling each side at base between staminodes and stamen. *Staminodes* cream, curved outwards, less than 2 mm. long, narrowly triangular, acute. *Filament* narrow, 3 mm. long, pale pinkish, glabrous; *anther* nearly 5 mm. long, pale yellowish, not papillose, with a small blunt triangular crest little over 1 mm. long. *Fruiting* inflorescence about 5–9 cm. long (lateral ones shorter); pedicels of fruits 3–5 mm. long. *Fruits* apparently red; about 1·5 cm. long and 1 cm. wide, close, more or less pyriform and somewhat angled where they meet.

The above description is taken mainly from Corner's Kemaman collection (including alcohol material) and his field notes. This is a much shorter species than either of the others, and has a short inflorescence quite near the ground. The leaves are glabrous as in *P. lateralis*, but wider (nearly as large as in *P. mucida*) and with longer ligules. The bracts disintegrate as in *P. mucida*. The colour of the flower is distinct, in having pink veins on either side of a median yellow band as in many species of Amomum. The anther is not papillose and has a larger crest than in *P. mucida;* the lip has a less deeply cleft apex.

P. albiflora has been found in Johore, Trengganu and Perak; it apparently does not grow in such wet places as *P. mucida*.

SPECIMENS. *Johore.* Kukub, Ridley 13336 (Type). Base of G. Panti, Ridley s.n. December 1892. Bukit Tinjau Laut, S.F.N. 37091 (Ngadiman). *Trengganu.* Bukit Kajang, Kemaman, 500 feet, S.F.N. 30426 (Corner). *Perak.* Ulu Temango, Ridley 14414.

6. HORNSTEDTIA RETZIUS

Tall plants; *rhizome* thick (rarely slender), woody, branched, intervals between leaf-shoots usually short, close to surface of ground, slightly covered or sometimes raised more or less above the surface on stilt-roots. *Inflorescence* ± fusiform or ellipsoid, or narrowly cup-shaped, arising from rhizome close to the base of leafy shoots; peduncle usually short, covered with 2-ranked scales. *Bracts:* an involucre of sterile bracts surrounding the inflorescence usually quite enclosing the floral bracts and tubes of the flowers, with a small aperture through which the flowers emerge. *Involucral bracts* ovate or oblong, stiff, reticulate or ribbed or smooth on the outside. Flowers opening very few at a time. *Floral bracts* each with a single flower (except in *H. leonurus*), equal in length to the tube of the flower, smooth, mucilaginous. *Bracteoles* one to each flower, except in *H. leonurus* not tubular at base, usually about half as long as corolla-tube. *Calyx* tubular at base, split down one side in the upper part, widened upwards, at apex 3-toothed or 2-lobed. *Corolla* with long slender tube; lobes about equal in length; dorsal lobe widest, hooded, erect or decumbent, laterals either close to the lip and partly adnate to it, or close to the dorsal lobe. *Staminodes* none or reduced to small teeth at base of labellum. *Labellum* ± rigid and fleshy, concave, when spread out triangular, ovate or hastate, usually auriculate at the base, the auricles erect or inflexed, apex oblong-rounded, not or hardly longer than corolla-lobes. *Stamen* as long as petals and lip or shorter, usually appressed to the lip. *Filament* rigid, fleshy, with thickened edges, continuous with the connective which is produced to a round tip beyond the anther, or none. *Anther either* adnate below the apex of the wide connective, with parallel narrow densely hairy pollen-sacs, the lines of dehiscence short and prolonged at the base into sterile spurs, *or* sessile, elongate, with narrow connective, usually thickened and recurved above the pollen-sacs, sometimes slightly 2-lobed; pollen-sacs very hairy, sometimes divaricate at apex, and sometimes free at base. *Ovary* oblong, 3-locular, many-ovuled, often on a short pedicel. *Style* slender. *Stigma* small, swollen, ± cup-shaped. *Stylodes*

elongate and narrow or short and fleshy, 2-8, usually ± united in a tube. *Syncarp* globose, enclosed in the involucral bracts. *Fruits* globose or oblong, laterally compressed, the pericarp thin and tough or woody, smooth outside, splitting irregularly near the base, not regularly dehiscent. *Seeds* multiangular, black, with a thin saccate aril.

As pointed out by Valeton, Hornstedtia is a very distinct genus, though it seems to be more nearly related to Achasma and Phaeomeria than Valeton realized. Achasma is however nearer to Phaeomeria than to Hornstedtia, and the union of Achasma with Hornstedtia (leaving Phaeomeria separate), as in the arrangements of Ridley and Schumann, is unsatisfactory. The distinctive features of Hornstedtia are: the more or less fusiform inflorescence covered with stiff sterile involucral bracts, which remain to enclose the fruits, the lateral open bracteoles (except in *H. leonurus*), the smooth fruits with tough (not fleshy) walls which are not regularly dehiscent, the long corolla-tube and relatively short equal lobes, the fleshy concave narrow lip not usually longer than the corolla-lobes, the small size or absence of staminodes, and the connective of the anther prolonged into fleshy narrow rounded tip, or not prolonged beyond the pollen-sacs.

Within the genus there is much variation of detail. The most distinct group of species is that of *H. scyphifera*, in which the tip of the anther is always thin and rounded, the pollen-sacs sterile in their basal parts, and the lip always enclosed by the two lateral corolla-lobes which are partially adnate to it. The calyx is always short (about half the length of the corolla-tube) and 2-keeled towards the apex, with short subapical teeth, and the bracteole is keeled with a subapical tooth. In *H. scyphifera* itself and its near allies the involucral bracts have also a raised reticulate pattern; but in the small species *H. phaeochoana*, the bracts are quite smooth. The latter species is also peculiar in having a slender rhizome with rather long intervals between the leaf-shoots.

The other members of the genus are more varied. Valeton recognized two sections; but *H. leonurus* does not belong to either, and probably *H. pusilla* is again different.

H. scyphifera is here treated in a broad sense, two distinct varieties being recognized in addition to the typical form. It may be that these should rank as separate species, but the correlation of their characters is not fully established. They are all nearly related. The very remarkable long stilt-roots of var. *grandis* carry the rhizome high above the ground; in this they match exactly the closely allied species *H. pininga* of Java and Sumatra. The lowland var.

fusiformis has shorter stilt-roots of a similar kind. Such stilt-roots are not found in Achasma, but are common in the genus Geostachys.

Apart from *H. scyphifera*, which is certainly the commonest Malayan species, *H. leonurus* and *H. conica* are widely distributed in the lowlands and have been collected at many localities. *H. ophiuchus*, *H. striolata* and *H. pusilla* are still each known from one collection only. Few Hornstedtias have been collected on the mountains, and none with long peduncles such as occur in Sumatra, Java, Borneo and the Philippines. It is quite possible that more species remain yet to be discovered.

Hornstedtia is probably derived from the Alpinia stock, but not on the same line of evolution as Amomum. Like Amomum, it has a reduced flowering stem, and the cincinni of Alpinia reduced each to a single flower; but it is even more specialized. It has the basal flowering bracts sterilized and forming a protective involucre, the fertile bracts being smaller; it has in most cases a very short inflorescence-axis which does not elongate during flowering; it has normally non-tubular bracteoles.

There is one peculiar species which gives evidence that the single flowers of Hornstedtia represent each a reduced cincinnus; this is *H. leonurus*, the arrangement of bracts and flowers in which is here for the first time fully described. Each bract encloses two flowers, and these are arranged, with their bracts (bracteoles) exactly like the flowers of a cincinnus in Alpinia or Geostachys. They show *H. leonurus* as retaining two primitive characters lost by the other species; the additional flower, and also the tubular bracteoles. The latter character is (so far as known) quite peculiar in Hornstedtia, and might be regarded as a basis for generic separation of *H. leonurus;* but there is no other genus to which it could be assigned. It is certainly neither Achasma nor Phaeomeria, but it forms a link between Hornstedtia and those genera, showing them more nearly allied to Hornstedtia than was realized by Valeton.

KEY TO HORNSTEDTIA IN MALAYA

Calyx not much more than half as long as corolla-tube; connective prolonged beyond anther as a flat rounded tip to the stamen

Bracts of the involucre with longitudinal ribs, and irregular cross-bars between the ribs, the cross-bars over part of the bract covered with a felt of very short white hairs, sometimes partly confluent so as

to form a continuous white covering but always distinct towards the apex of the bracts
Cross-bars towards apex of bracts glabrous, dark red like rest of bract
Leaves glabrous on upper surface; auricles of lip 5 mm. wide, overlapping; apex of involucre open, narrowly cup-shaped
1. *H. scyphifera* (typical).
Leaves with some hairs on upper surface; auricles 3 mm. wide, not overlapping, apex of involucre pointed, not cup-shaped
H. scyphifera var. *fusiformis.*
Cross-bars white throughout, usually ± confluent in basal part of bract
Rhizome supported on long stilt-roots some distance above ground; petioles of leaves 1–2 cm. long *H. scyphifera* var. *grandis.*
Rhizome not so supported; petioles 5–6 cm. long; cross-bars on bracts showing separately only near the apex 2. *H. striolata.*
Bracts quite glabrous, smooth when living, finely longitudinally ridged when dry 3. *H. phaeochoana.*
Calyx nearly as long as corolla-tube; connective not prolonged beyond tip of anther which is notched between the pollen-sacs
Very small plants; height to 40 cm., leaves to 18 cm. long, bracts to 3 cm. long 4. *H. pusilla.*
Plants much larger
Lip about 1·4 cm. longer than corolla-lobes, distal part widened, with crinkled edges; stamen much shorter than lip 5. *H. conica.*
Lip about same length as corolla-lobes, not so widened nor crinkled; stamen nearly as long as lip
Bracts longitudinally ribbed, covered almost entirely by fine silky hairs which in part form little tufts 6. *H. ophiuchus.*
Bracts not ribbed, bearing fine hairs which are not felted nor tufted 7. *H. leonurus.*

KEY TO HORNSTEDTIA IN MALAYA: VEGETATIVE AND BRACT CHARACTERS ONLY

Bracts of the involucre with longitudinal ribs, and irregular cross-bars between the ribs, the cross-bars over part of the bract covered with a felt of very short white hairs,

sometimes partly confluent so as to form a continuous white covering

Cross-bars towards apex of bracts glabrous, dark red like rest of bract

Leaves glabrous on upper surface; apex of involucre open, narrowly cup-shaped; rhizome at surface of ground, or close to it
1. *H. scyphifera,* typical.

Leaves with some (often many) hairs on upper surface; apex of involucre pointed, not cup-shaped; rhizome supported on short stilt-roots
H. scyphifera var. *fusiformis.*

Cross-bars white throughout, usually confluent in basal part of bract

Rhizome supported on long stilt-roots (up to 120 cm. long); petiole 1–2 cm. long
H. scyphifera var. *grandis.*

Rhizome not so supported; petioles 5–6 cm. long; cross-bars of bracts separate only near apex
2. *H. striolata.*

Bracts without cross-bars, sometimes without ribs or hairs

Bracts not more than about 4 cm. long, glabrous, smooth (ribbed when dry)

Whole plant about 40 cm. tall, leaves to 18 cm. long
4. *H. pusilla.*

Whole plant about 200 cm. tall, leaves to 33 cm. long
3. *H. phaeochoana.*

Inner involucral bracts to 8 or 9 cm. long

Bracts with white silky hairs, felted or in little tufts, over most of their outer surface; surface finely ribbed; leaves rounded to truncate at base

Inflorescence narrowly fusiform, pointed; petioles 2–3 cm. long
5. *H. conica.*

Inflorescence with inner bracts spreading a little at their tips; petioles 1 cm. long
6. *H. ophiuchus.*

Bracts not ribbed, covered with appressed silky hairs which are not felted nor tufted; leaf-blades dark green, shining, with truncate or slightly cordate base
7. *H. leonurus.*

1. **Hornstedtia scyphifera** (Koenig) Steud., Nomencl., 2 ed. 1: 776. 1840 (Typical form of species). *Amomum scyphiferum* Koenig in Retz. Obs. 3: 68. 1768. *Hornstedtia scyphus* Retz. Obs. 6: 18. 1786. Ridl., Flora 4: 267. **Fig. 19.**

Rhizome at or just below surface of ground, stout, covered with short 2-ranked sheaths. Intervals between successive leaf-shoots c. 15 cm. or less. *Leaf-shoots* 2–5 m. tall, with 16 or more leaves, the lower 1/3 covered with sheaths only. *Leaves* green, with pale yellow-green grooved midrib on upper surface: sheaths green to yellow-green, hairy as midrib of leaf. *Leaf-blade* to 85 by 18 cm., narrow apex short, base unequal, rounded; upper surface glabrous, lower surface glabrous or more or less covered with short soft hairs, midrib with longer hairs. *Petiole* 1–2 cm. long; *ligule* 1–2 cm., usually hairy, sometimes glabrescent. *Inflorescence* usually from near base of leaf-shoot, on a short scape; total height including scape to about 15 cm. Scape covered with overlapping 2-ranked scales which grade into involucral bracts. *Involucral bracts* completely covering rest of inflorescence except for tips of expanded flowers; shape of involucre narrowly cup-shaped, the rim (1·5–3 cm. diameter) narrower than the maximum diameter towards the base (3 to 4 cm.); *number* of involucral bracts about 10; *largest* 8 to 9 cm. long, 5 cm. wide: broadly ovate with rounded sometimes slightly hairy apex and a very short stiff tip; outer surface of bracts finely longitudinally ribbed, with irregular cross-bars between the ribs, cross-bars glabrous towards the apex of the bract, covered with minute felted whitish hairs in the middle and towards the base, tip and edges of bracts very deep crimson, hairy parts whitish. *Floral bracts:* outer ones a little shorter than involucral bracts, and to about 2·5 cm. wide, gradually decreasing in length and width towards the middle of the inflorescence, down to about 6 cm. long and 1·5 cm. wide, basal parts white, apical parts pink to crimson, rounded with usually a short slightly hairy tip. At centre of inflorescence c. 4 smaller sterile bracts. *Flowers* opening 1–3 at a time, lasting one day, the corolla-tube then elongating a little more and hanging down limply; one flower to each bract. *Bracteole* embracing base of flower and pedicel, lateral, c. 3·5–4 cm. long, narrow, keeled on the black with a short stiff hairy point on the back just below the tip, edges thin translucent, rest pink, or white towards base. *Pedicel* of flower 1–3 mm. long. *Ovary* c. 5 mm. long, glabrous except for a ring of hairs at junction with calyx. *Calyx* pink with crimson apex, 3–3·5 cm. long, widening upwards, with 2 keels each ending in a short tooth (1 mm. long) just below the tips of the very thin lobes; sinuses between lobes unequal, one about 1 cm., the other 4 mm., glabrous except for a few hairs on and near the teeth. *Corolla-tube* 6–8 cm. long, bright scarlet, slender. *Lobes* coloured as tube, oblong, concave, ends rounded; dorsal lobe to 2·3 cm. long, 9 mm. wide when flattened, laterals a little shorter, 5 mm. wide when flattened, their adjacent edges connate for more than half their length with the lower surface of the lip, entirely enfolding the lip except at its tip. *Labellum* slightly longer than lateral corolla-lobes and similarly coloured, fleshy, concave, with rather large overlapping infolded white-edged auricles at the base, the apex oblong with rounded tip, the inner surface rather copiously hairy except near tip and edges,

the outer surface with scattered hairs. *Staminodes* on either side at base of lip, close to attachment of stamen, fleshy, flattened, sometimes slightly 2-toothed, white, 1·5 mm. long and wide, bearing a few slender hairs like those inside the lip; bases of staminodes decurrent as a thickening inside the tube of the flower. *Filament* of stamen flattened, to about 8 mm. long, continuous with the connective. *Anther* lying flat inside the lip, its back covered by the auricles, including free tip of the connective 1·5 cm. long, maximum width 4–5 mm.; free tip of connective rounded, 2·5 mm. long; thecae hairy; line of dehiscence c. 7·5 mm. long, sterile basal part 5 mm. long with hairs on inner sides of the thecae only; anther crimson on the back, hairs and pollen white. *Style* hairy, white at the base, pink at tip; stigma pale pink, flattened, the opening a transverse narrow ellipse, hairy outside. *Stylodes* slender, 1·4–1·6 cm. long, cleft to base on one side, a little way on the other, pale pink. *Fruiting* inflorescence 6 cm. or more wide near the base; each fruit about 3 cm. long, smooth, longer than wide, with pedicel 5 mm. long.

SPECIMENS. *Singapore.* Kranji F.R., J.S.G., Ap. 1890. Toas, Ridley s.n. February 1890. Bukit Timah, Ridley 4616; Henderson 1377 (Herb. F.M.S. Mus.). Sungei Jurong, Ridley 446. Sungei Buloh, Ridley s.n. 1894. Reservoir Woods, S.F.N. 7038 (Burkill). Cluny Road, S.F.N. 243 (Burkill). *Johore.* Batu Pahat, Ridley s.n. November 1900. Tanjong Bunga, Ridley s.n. 1894. *Selangor.* Bukit Etam, 2,000–3,500 feet, Kelsall s.n. 1891. Kuala Lumpur, Ridley 10175. Petaling, Ridley s.n. 1889. *Pahang.* Gunong Tahan, 3,000 feet, S.F.N. 20592 (Holttum). *Trengganu.* Bukit Kajang, 1,000 feet, S.F.N. 30379 (Corner). *Dindings.* Bruas, Curtis s.n. December 1902. *Distribution:* Sumatra and Borneo.

var. fusiformis Holtt., **var. nov.**

Folia supra hirsuta; auriculae labelli 3 mm. latae, non imbricatae; apex involucri acutus (involucrum non cyathiforme).

Rhizome raised 15–20 cm. above ground on red stilt-roots. *Leaf-shoots* 2–3 m. tall, sheaths greenish. *Leaves:* blade to 50 by 9 cm., copiously hairy on both surfaces; hairs on upper surface sometimes of two kinds, rather coarse wavy scattered hairs 2 mm. or more long, and sometimes also very short copious fine hairs; hairs on lower surface under 1 mm. long, copious, soft; *petiole* to 1·5 cm. long; *ligule* to 1·5 cm. long with spreading hairs to 5 mm. long. *Leaf-sheaths* densely hairy with pale spreading rather harsh hairs 3–4 mm. long. *Inflorescence* to about 12 cm. tall including peduncle, rather narrowly fusiform with narrow acute tip; maximum diameter c. 2·5 cm. *Involucral bracts* with ribbing and hairs as in typical *H. scyphifera*, but with narrower tips. *Flowers* about same size as in typical *scyphifera*, except that the corolla-lobes and lip are a little shorter (2 cm.). *Lip* with auricles only 6 mm. long and 3 mm. wide, not overlapping.

SPECIMENS. *Trengganu.* Bukit Kajang, Kemaman, S.F.N. 30236 (Corner)—*TYPE*. *Kelantan.* Gua Ninik, S.F.N. 19751 (Henderson). *Selangor.* Klang Water Catchment Forest, S.F.N. 8349, 9164 (Burkill). Ginting Simpah, Hume 8716 (Herb. F.M.S. Mus.).

This differs from the typical form of the species in the very hairy leaves and sheaths (especially the hairy upper surfaces), in the rhizome being raised on short stilt-roots, in the fusiform inflorescence and small auricles of the lip. In the fusiform inflorescence it agrees with *H. villosa* (Val., Ic. Bog. 2: t. 170; Bull. Btzg., 3rd Ser. 3: 166) but that species has no bracteoles, no staminodes, very short stylodes, no auricles to the lip, no hairs on upper surface of leaves, and bracts not reticulate on the outer surface.

One of Burkill's specimens from Klang has only a few coarse hairs on the upper surface of the leaves, the other has many. Only Corner's specimen from Kemaman has both long and short hairs on the upper surface. As regards the stilt-roots, these are only recorded for Corner's specimen; there is no information about the roots of the others. One of Burkill's Klang specimens appears to lack bracteoles, but they are certainly present in Corner's specimen. Further collections are needed to show whether all the peculiar characters are always correlated with each other. If they are, this variety might rank as a species. It is as distinct as some others in this group.

var. **grandis** (Ridl.) Holtt., **stat. nov.** *Hornstedtia grandis* Ridl., J.S.B.R.A.S. 32: 141. 1899. Flora 4: 268.

Rhizome raised above ground 50–120 cm. on stout reddish stilt-roots. *Leaves* glabrous except for ligule and lower surface of petiole and adjacent parts of sheath which are hairy; hairs on ligule sometimes rather long. In some plants lower surface of leaves is also softly hairy. *Inflorescence* usually somewhat larger than in typical form of species, to 18 cm. long including peduncle. *Involucral* bracts with hairy cross-bars throughout their outer surface except for edges which sometimes have a fringe of longer hairs; middle and basal part of bracts having the hairy cross-bars broad and sometimes quite confluent so that the surface is mainly white and sometimes partly greenish. *Flowers* rather large, with corolla-tube to 9 cm. long. *Calyx* teeth 2 mm. long. *Auricles* of lip 1·1 by 0·5 cm.

Apart from the very long stilt-roots, this is so near typical *H. scyphifera* that I think it is best regarded as a variety. It agrees in habit with *H. pininga* (Bl.) Val. of Java and Sumatra (see Bull. Btzg. 3rd Ser. 3: 163, and Ic. Bog. 2: t. 169) but the flowers are always red (so far as recorded) and the shape of the inflorescence is widened at the mouth, as in typical *H. scyphifera,* not narrowed as in *H. pininga;* the bracts also are broader than in *H. pininga.* It is actually nearer to typical *H. scyphifera* than is the var. *fusiformis* described above.

H. scyphifera var *grandis* appears to be locally common in forest on the mountains of the Main Range and Taiping Hills at about 4,000 feet, and is a most striking

plant, with its stout rhizome propped up on its long stiff red stilt-roots. The leaf-shoots rise 3 m. or more above the rhizome.

SPECIMENS. *Pahang.* Fraser's Hill, S.F.N. 8584 (Burkill and Holttum); S.F.N. 33180 (Corner). Telom, Ridley 13823. Boh Plantations, Cameron Highlands, S.F.N. 32907 (Md. Nur). Sungei Telom 3,900 feet, S.F.N. 31427 (Holttum). *Perak.* Maxwell's Hill, Ridley s.n. June 1893 (Type); 4,000 feet, Curtis 2072. Box Hill, Ridley 11450. Birch's Hill, 3,900 feet, S.F.N. 12651 (Burkill and Haniff).

2. **Hornstedtia striolata** Ridl., Mat. Fl. M.P. 2: 36. 1907. Flora 4: 268.

Leaf-shoots tall. *Leaves* to 50 by 6 cm. or more; apex rather long-pointed (c. 2·5 cm.), base rather narrowly cuneate, slightly unequal; minutely hairy all over the upper surface (hairs c. 1/10 mm. long) and on midrib beneath; *petiole* 5–6 cm. long, rather slender, minutely hairy; *ligule* 1·5 cm. long, minutely hairy. *Inflorescence* with peduncle c. 15 cm. tall, in shape and shape of bracts resembling that of *H. scyphifera. Largest involucral bracts* c. 7·5 cm. long and nearly 4 cm. wide. *Involucral bracts* longitudinally ribbed, and covered nearly throughout with a felt of minute hairs, which is reduced to broad cross-bars near the apex only; apex and narrow edges red, with scattered hairs c. 1 mm. long. *Bracteole and calyx* as in *H. scyphifera:* calyx c. 3·5 cm. long, with a ring of hairs 2 mm. long at the base, at junction with ovary. *Corolla-tube* c. 6 cm. long; lobes 2 cm.: lobes of corolla, lip and stamen shaped as in *H. scyphifera,* the lip with broad overlapping auricles folded over the back of the stamen. Hulu Semangko, Ridley 12105 (Type). Only collection.

This species is certainly closely allied to *H. scyphifera.* The very close felted covering almost all over the outer surface of the bracts as in *H. pininga* (Bl.) Val. var. *aurantiaca* Val., almost obscures the tessellated effect characteristic of *H. scyphifera,* but the separate cross-bars can be seen near the apex of the bracts. The shape of the bracteoles and flowers is almost identical with that of *H. scyphifera.* The most striking feature of difference is the very long slender petiole of the leaves, and the minute hairs all over the upper surface of the leaves. Similar but longer hairs are sometimes found in *H. scyphifera* var. *fusiformis.* Further information about the vegetative parts of this species is needed before its position can be properly established.

It should be noted that the leaf is very similar in shape and length of petiole to *Cenolophon* (or Alpinia) *petiolatum,* but the latter species has not a similar pubescence and its ligules are bilobed. The possibility should however not be overlooked that the leaf mounted with the inflorescence of Hornstedtia is a Cenolophon, not Hornstedtia leaf. Accidental mixing of specimens during drying

sometimes occurs and is difficult to detect unless one has made careful field notes.

3. **Hornstedtia phaeochoana** (K. Schum.) K. Schum. Pflanzenr. Zingib. 191. 1904. *Amomum phaeochoanum* K. Schum., Englr. Jahrb. 27: 304. 1899.

Rhizome slender, a little below surface of ground, intervals between leaf-shoots to 40 cm. or more. *Leafy shoots* to 2 m. tall or rather more, 45–90 cm. to first leaf, leaf-sheaths dark green. Swollen base of shoot greenish white covered with brown sheaths. *Leaves* rather dark green above (when dry, red brown below, olive-brown above), blade to 33 by 7·5 cm. (Schumann says to 42 by 6·5 cm.), rather fleshy when living and coriaceous when dry, apex rather gradually narrowed and shortly acuminate, base cuneate, glabrous; petiole 5–8 mm. long, slightly hairy on edges; ligule to 1 cm. long, hairy on edges; sheaths glabrous. *Inflorescence* often some distance from leafy stems, the peduncle below ground. Peduncle 2–5 cm. long, covered with overlapping small sheaths. Inflorescence fusiform, to about 5 cm. long and 2 cm. wide; involucral bracts numerous, white with rose-red tips when living, red-brown with dark edges when dry, quite glabrous, to about 4 cm. long, ovate, apex blunt with a very short stiff tip, surfaces quite smooth when living, finely longitudinally ridged when dry. *Floral bracts* 3–4 cm. long, thin, tips acute. *Bracteole* a little shorter than calyx, shaped as in *H. scyphifera*. *Calyx* a little over half length of corolla-tube, like ovary quite glabrous, at apex with three spine-like teeth 2 mm. long one of which is at the apex in the bud and is carried off at apex of dorsal corolla-lobe. *Corolla-tube* about as long as bracts; crimson. *Lobes* crimson, about 1·5 cm. long, the lateral lobes side by side embracing the lip, but apparently not joined together, the dorsal same length and wider. *Lip* a little longer than corolla-lobes, pale pink, oblong, concave, entirely glabrous, without basal auricles. *Stamen* as long as the lip and lying within it, structure exactly as in *H. scyphifera*. *Staminodes* none or very small. *Stigma* and style hairy, stigma shaped as in *H. scyphifera*.

Johore: S. Sedili, Mersing Road, S.F.N. 31946 (Corner).

The type of this species was collected by Beccari near Kuching, Sarawak. It was incompletely described, but all specified details agree with the Johore specimens; size of leaves and inflorescence, glabrous bracts drying with a brown edge and pruinose near the tips, glabrous calyx and ovary, calyx much shorter than bracts, and leaves red-brown beneath when dry.

H. phaeochoana belongs to the group of *H. scyphifera*, having flowers and bracteoles of closely similar structure. It is the smallest reported species of the group. Apart from the small size, an unusual feature is the very long slender rhizome-elements between successive leaf-shoots.

4. **Hornstedtia pusilla** Ridl., J.S.B.R.A.S. 32: 143. 1899. Flora 4: 269.

Rhizome slender. *Leafy stems* (including leaves) to about 40 cm. tall: leaves to about 5. *Leaf-blade* to 17·5 by 4 cm.,

apex with narrow tip 2 cm. long, base rounded to cuneate, surfaces glabrous; petiole none; ligule less than 2 mm. long, with short hairs. *Inflorescence* from underground rhizome: peduncle c. 2 cm. long. *Involucral bracts* to 3 cm. long, ovate, glabrous, longitudinally ribbed when dry, with a very short stiff tip, red when living. *Calyx* hairy, to 4 cm. long, teeth at apex short. *Corolla-tube* little longer than calyx, red, lobes red. *Lip* narrow, entire, fleshy. *Stamen:* anther 9 mm. long, apex emarginate (?) connective not produced into a rounded tip.

Pahang: Kuala Tembeling, Ridley s.n. 1891.

This very small species appears to be quite distinct from any other described. The only specimen known has incomplete and broken flowers, but it seems clear that the calyx is longer than the bracts, an unusual feature in the genus. Bracteoles may be present, but have not been distinguished. The corolla-lobes and lip are so broken as to be indistinguishable (details given are from Ridley) ; the anther is also broken. The pollen-sacs are hairy throughout, and appear to be dehiscent from base to apex. Further information is needed to establish the genus of this species; it might be an Achasma, but I do not think so.

5. **Hornstedtia conica** Ridl., J.S.B.R.A.S. 32: 142. 1899. Flora 4: 268. *Hornstedtia alliacea* Valet., Ic. Bog. 4: t. 350. 1912. Bull. Buitenz. 3rd Ser. 3: 174.

Rhizome at or just below surface of ground. *Leafy shoots* rather near together, 2–3 m. tall; sheathing basal part grey-green, upper sheaths sometimes reddish. *Leaves:* blade dark green, midrib yellowish beneath, to about 65 by 12 cm., apex shortly pointed, base slightly unequal, rounded to truncate, glabrous or very shortly hairy beneath and sometimes also in the groove of the midrib above; *petiole* 2–3 cm. long; *ligule* to 2 cm., glabrous. *Inflorescences* entirely above ground; height of inflorescence including short peduncle 9–12 cm., shape fusiform with a long slender tip, maximum diameter c. 2·5 cm. *Involucral* bracts pale pink with dull red edges, the backs covered for the greater part with very fine short white silky hairs, sometimes in little separate tufts. Inner bracts 8–9 cm. long, about 2·5 cm. wide near base, narrowed gradually to apex; apex blunt with a short stiff point; outer bracts shorter, apex more rounded. *Floral bracts* narrower, thinner, about as long as the inner involucral bracts. *Flowers* one open at a time. *Bracteoles* to 5 cm. long, narrow, appressed to the calyx. *Ovary* hairy c. 5 mm. long. *Calyx* white, hairy outside, in bud forming a long slender tip beyond the corolla, in the open flower nearly as long as the corolla-tube, split about half way to the base on one side, the apex usually with 2 or 3 short lobes and 3 very short recurved teeth. *Corolla-tube* 6·5–7 cm. long, white; lobes almost erect 2–2·5 cm. long, the dorsal one 7 mm. wide, the others a little narrower, standing on either side of the dorsal one, all rose-red. *Lip* rather pale clear pink with two longitudinal crimson lines, curved to a horizontal position, about 1·4 cm. longer than the corolla-lobes, the blade widened a little from the base, with crinkled edges, basal auricles small, erect on either side of

anther. *Stamen* enclosed by corolla-lobes and base of lip, extending to the auricles of the lip only; filament short; anther with apex emarginate between the thecae; line of dehiscene not reaching apex of thecae; base of thecae free for a very short distance. *Stigma* not much swollen, the mouth crescent-shaped. *Stylodes* short and slender. *Fruiting* inflorescence widened to 4 or 5 cm. near the base, onion-shaped. Fruits about 3 cm. long, of irregular cross-section, to about 2 cm. wide, on pedicel 3 mm. long. *Distribution:* Java, Sumatra.

SPECIMENS. *Singapore.* Bukit Panjang, Ridley s.n. *Johore.* Base of G. Panti, Ridley s.n. December 1892. Patani, Batu Pahat, Ridley 11195. *Selangor.* Bukit Hitam, Ridley 7803. Langat, Ridley s.n. July 1889. *Pahang.* S. Sat, Ulu Tembeling, S.F.N. 21987 (Henderson). G. Senyum, base, S.F.N. 22381 (Henderson). Jerantut, S.F.N. 15835 (Burkill and Haniff). *Trengganu.* Ulu Kajang, Kemaman, 500 feet, in swamp, S.F.N. 30433 (Corner).

This species is undoubtedly identical with *H. alliacea* Val., excellently described and illustrated by Valeton. He noted the probable identity of the species, but in view of Ridley's imperfect description did not himself unite them. The characteristic features are the long-pointed inflorescences with silky hairy bracts, the lip much longer than the corolla-lobes (resembling Achasma in this), the short stamen with emarginate apex, the rhizome at or near ground surface and the rather long-stalked glabrous leaves.

H. conica is evidently a lowland species, probably less common than *H. leonurus* but extending to most parts of Malaya. It seems to be very uniform in character.

6. **Hornstedtia ophiuchus** (Ridl.) Ridl., J.S.B.R.A.S. 32: 141. 1899. Flora 4: 268. *Amomum ophiuchus* Ridl., Trans. Linn. Soc. 3: 381. 1893.

Leafy shoots to 4 m. tall. *Leaves* to 55 by 9 cm. or more, base rounded, slightly unequal, surfaces glabrous; petiole 1 cm. long; ligule 1 cm., short-hairy. *Inflorescence* fusiform but not narrowly pointed, c. 13 cm. tall including the short peduncle. *Involucral bracts* finely longitudinally ribbed, covered with a close felt of very short appressed hairs except towards the apex; inner bracts to 9 cm. long, narrowed to the tip. *Ovary* densely appressed-hairy; *calyx* similarly *hairy* towards the base, hairs fewer upwards, to about 8 cm. long, deeply cleft down one side. *Corolla* red, the tube a little longer than the calyx, lobes hardly 2 cm. long, the lateral lobes joined to the lip and enfolding it. *Lip* as long as corolla-lobes, concave, fleshy, red with white edges, hairy within, apparently without auricles at the base. *Stamen* c. 3 mm. shorter than the lip and lying within it, the anther hairy, emarginate at the tip.

Only known from the original collection: Tahan River, Ridley July 1891. Valeton suggests that this species may be identical with *H. minor* (Bl.) Val., known from Java and Borneo. This may be correct, but the inflorescence of

the type of *H. ophiuchus* is much shorter than in *H. minor*, and many comparative details are lacking. When further material is available, a comparison may easily be made with Valeton's plate in Ic. Bog. 2, t. 167.

7. **Hornstedtia leonurus** (Koenig) Retz., Obs. Bot. 6: 18. 1786. Ridl., J.S.B.R.A.S. 32: 142. Flora 4: 269. *Amomum leonurus* Koenig, Retz Obs. Bot. 3: 69. 1783. *Amomum Ridleyi* Bak., Kew Bull. 1892: 128. *Stenochasma convolutum* Griff., Notul. 3: 433, t. 359. 1851. **Fig. 20.**

Rhizome ± deep underground: intervals between leafy stems about 10 cm. *Leafy shoots* to 4 or 5 m. tall, 1·5–2 m. to the first leaf; swollen base to 6 cm. thick, ± red-brown. *Leaves:* blade to about 60 by 14 cm., oblong, apex rounded with a narrow tip c. 1 cm. long, base truncate or even subcordate, slightly uneven, upper surface dark glossy green, the edges broadly crisped; edges of blade, the whole petiole and ligule and upper part of sheath conspicuously brown-hairy; petiole 1–2 cm. long; ligule 1–1·5 cm. long, bearing longer hairs than blade. *Inflorescence:* scape from the rhizome, erect, subterranean, length from 2 cm. Inflorescence narrowly fusiform, 7 to 11 cm. long, partly buried in the ground. 1–2 flowers open together. *Involucral bracts* about 8, the inner ones to about 9 by 2·5 cm., narrowing gradually upwards, end rounded with a very short point; outer surface smooth, not ribbed, covered almost throughout with short appressed silky hairs which do not form a dense felt; general colour of bracts where underground pale pinkish to buff, the inner ones, where exposed to light, green with pinkish tips. *Floral bracts* to about 8 cm. long and 1·5 cm. wide, inner ones narrower, silky appressed hairy on back, each enclosing 2 flowers. *Bracteoles* two to each bract, one enclosing both buds and one the smaller bud only, largest bracteole 6–7 cm. long, apex unequally 2-lobed, the base of both bracteoles tubular for a length of 2–2·5 cm. Inner bracteole with a small tooth below apex. *Calyx* to 8·5 cm. long, pale pink, teeth very short and close together, split about 1·7 cm. on one side, appressed hairy throughout externally. *Corolla-tube* about as long as calyx, dorsal lobe about 3·7 cm. long and 1·2 wide when flattened, strongly concave, the lateral lobes a little shorter and about half as wide, usually folded within it, all lobes dull deep crimson. *Staminodes* none. *Lip* c. 3·7 cm. long, the base 6 mm. wide, widening abruptly to form a pair of auricles and then tapered to a narrow rounded apex, maximum width when flattened 2 cm.; auricles erect, their tips inflexed a little; colour of lip crimson, edged and tipped with pale pink. *Filament* of stamen crimson, 2 cm. long, with thickened edges. Anther 1·4 cm. long, dark crimson, the pollen-sacs densely covered with hairs, dehiscent throughout their length, their bases free for about 4 mm.; apex of connective short but distinct, emarginate *Stigma* crimson. *Stylodes* 9 mm. long, forming a tube round the base of the style split to the base down one side and for a short distance down the other side. *Fruit* faintly pinkish when young, nearly black when ripe, very short hairy, to about 2 cm. long, on a short pedicel; wall thin; involucral bracts at fruiting persistent but pressed outwards to expose the fruit partly.

SPECIMENS. *Singapore.* Panjang Reserve, Ridley 96. Chan Chu Kang, Ridley s.n. 1892. Pulau Ubin, Ridley 9494. Sungei Buloh, Ridley s.n. 1894. Mandai Forest, Burkill 278. *Johore.* G. Panti, Ridley s.n. December 1892. Ulu Segun, G. Panti, 500–1,000 feet, S.F.N. 30746 (Corner). *Pahang.* Beserah, S.F.N. 16142 (Burkill and Haniff). Kadondong, Pulau Tawar, Ridley s.n. August 1891. *Malacca.* Selandor, Alvins 686. *Perak.* Tapah, S.F.N. 13462 (Burkill and Haniff). *Dindings.* Bukit Sejari, Ridley s.n. March 1896.

For a note on this very interesting species, which has only been reported from the Malay Peninsula, see the introductory remarks on the genus. *H. leonurus* still occurs wild in the forest on Bukit Timah in Singapore, and is also abundant by paths in the Catchment forest near MacRitchie Reservoir. The dark green glossy stalked leaves with crisped edges are distinctive.

7. PHAEOMERIA LINDLEY

Rhizome at or near surface of ground, in the large species of short thick club-shaped elements between successive leaf-shoots, in *P. Maingayi* slender and wide-creeping. *Leafy shoots* often very tall; leaves large, stalked; ligule usually slightly 2-lobed. *Inflorescences* on long slender peduncles from base of leaf-shoots, the peduncle covered with well-spaced 2-ranked sheaths. *Head of inflorescence* short and broad, with an involucre of large sterile coloured bracts, erect or spreading, usually not persistent to fruiting; receptacle of inflorescence broad and nearly flat or elongating a few centimetres, bearing very many narrowly tubular flowers close together; flowers opening many together, in a series of concentric circles. *Floral bracts* narrow, thin, each with one flower, the outer ones wider than those near the centre of the inflorescence. *Bracteoles* tubular, 2 or 3-toothed, deeply split, shorter than the calyx. *Calyx* narrowly tubular, usually with 3 short teeth near together and rather deeply split down the other side. *Corolla-tube* much shorter than calyx; lobes as long as tube or longer, about equal, erect, their tips hardly surpassing the calyx, not widely spreading. *Lip* erect, ovate when spread out, the sides folded together at the base, the tip extending a little above the corolla-lobes and a little deflexed, the base joined to the stamen in a short fleshy tube above the junction of the corolla-lobes; after flowering stiffly inrolled from the apex in a spiral. *Staminodes* lacking, or as rudimentary hairy teeth or humps. *Stamen:* filament (free part) very short, erect; anther long, emarginate at the apex, slightly bent forwards towards the lip. *Stigma* rather large, the opening triangular, with a cleft on the broad forward side. *Stylodes* short and fleshy, apices irregularly

warty, encircling base of style, separate down one side to the base, joined on the other side. *Fruiting-head* round or elongate, the fruits close together, smooth (not ridged nor prickly), sometimes hairy, round or long-beaked; pericarp thick, fleshy, not dehiscing.

The name Phaeomeria was proposed by Lindley in 1836 for the species now known as *P. speciosa* (he called it *P. imperialis*). Horaninov in 1862 proposed the name *Nicolaia imperialis* for the same species; Nicolaia, being a later generic name, cannot stand. Bentham and Hooker included Phaeomeria in Amomum; it was re-established as a distinct genus by Schumann. The best critical work on the genus is that of Valeton, as quoted below under *P. speciosa*.

As shown by Valeton, Phaeomeria is nearly related to Achasma, differing in the long-peduncled inflorescences which usually have larger flowers, and in the much shorter lip which is little longer than the corolla and hardly spreads horizontally at the apex. The genus is entirely Malaysian, with *P. speciosa* as the only known widely distributed species. There are four quite distinct species in Malaya; all (except *P. speciosa*) appear to be distinct from the Sumatran species described by Valeton. A fifth species probably also exists. The young flowering heads of the large species are all eaten as a flavouring for food. The fruits do not appear to be used.

KEY TO THE MALAYAN SPECIES OF PHAEOMERIA

Inflorescence about 4 cm. wide and 4 cm. high; bracts of involucre hairy — 1. *P. Maingayi.*

Inflorescence wider; bracts glabrous

- Leaves with very broad bases; involucral bracts spreading horizontally, with or without deflexed ends; axis of inflorescence elongating, to 5 cm. or more
  - Involucral bracts c. 6 cm. long, apex very broad, not deflexed; fruits long-beaked — 2. *P. fulgens.*
  - Involucral bracts c. 8–12 cm. long, apex narrowed (except for a few outermost ones); fruits rounded at apex — 3. *P. speciosa.*
- Leaves cuneate to rounded at base; involucral bracts erect, forming a deep cup; axis of inflorescence hardly elongated, slightly raised in the middle only — 4. *P. venusta.*

1. **Phaeomeria Maingayi** (Baker) K. Schum., Pflzr. Zingib. 266. 1904. Ridl., Flora 4: 272. *Amomum Maingayi* Bak., F.B.I. 6: 235. 1892. *Hornstedtia Maingayi* Ridl., J.S.B.R.A.S. 32: 1899. **Fig. 21.**

Rhizome close to surface of ground, rather slender, long creeping, sometimes raised above ground and supported on short stilt-roots to 20 cm. long where aerial shoots arise. *Leafy shoots* 2–3 m. tall, c. 30–60 cm. apart. *Leaves* to about 50 by 12 cm. (sometimes upper leaves only 4 cm. wide), pinkish beneath when young, short-acuminate, glabrous, or short-hairy beneath; *petiole* to 1 cm. long; *ligule* to 1·2 cm. long in upper leaves, slightly 2-lobed, short-hairy on edges, very short-hairy on surface. *Peduncle* slender, c. 40–80 cm. tall, pinkish, glabrous, close to base of leaf-shoot, with well-spaced broad shortly mucronate dull red sheaths c. 3 cm. long (sheaths bright crimson on young inflorescence). *Inflorescence* almost spherical, c. 4 by 3·5 cm.: receptacle short-conical, 1 cm. tall, bearing c. 35 flowers. *Involucre* of c. 5 sterile bracts, the largest about 3 cm. long and 2·5 cm. wide, ovate, apex broadly rounded with a stiff point 2 mm. long, densely appressed-hairy all over back except near the thin edges, hairs whitish to yellowish, exposed edges pink to deep red. *Outer floral bracts* nearly as large as involucral, gradually smaller. Inner floral bracts 2·5–3 cm. long, c. 7 mm. wide, widest near broad blunt apex, tip incurved, very short or absent, hairy on back as involucre. *Bracteoles* c. 2 cm. long, tubular at base, slit down one side 7–8 mm., from the shortly 3-toothed apex, or sometimes 2-lobed, the slits unequal. *Calyx* crimson, c. 3 cm. long, with 3 adjacent rather broad lobes 3 mm. long (usually all behind the lip), each with a subapical tooth, slit c. 7–10 mm., appressed hairy outside. *Corolla-tube* much shorter than calyx, dorsal lobe about 1 cm. long and 4 mm. wide, a little shorter than calyx, others still shorter and about half as wide. *Lip* bright purplish red, spreading outwards at an angle of c. 45° to vertical, when straightened about 1·3 cm. longer than calyx, with paler inflexed sides at base partly embracing the anther: blade c. 8 mm. wide, edges crinkled, apex broadly rounded, tube and back of lip at base crimson like the calyx. *Stamen:* filament short (1 mm.) and broad: anther c. 8 mm. long, dark red. *Stigma* dark red, shining, nearly 3 mm. wide. *Fruits* shortly stalked, ± round, apex broad, not beaked, fleshy, smooth or very short-hairy, each c. 2 cm. long and wide, bright red, the head surrounded with the persistent involucre (head of fruits c. 5 cm. across).

SPECIMENS. *Malaya:* lowland forest, many localities, Singapore to the north. Type from Malacca (Maingay) at Kew.

var. longibracteata Holtt., **var. nov.**

Bracteae involucri c. 3 cm. longae, 1·5 cm. latae, apice anguste rotundatae; labellum basin versus albomarginatum. *Pahang*, Tembeling, S.F.N. 24522 (Henderson).

2. **Phaeomeria fulgens** (Ridl.) K. Schum., Pflanzenr. Zingib. 262. 1904. Ridl., Flora 4: 272. *Hornstedtia fulgens* Ridl., J.S.B.R.A.S. 32: 149. 1899. **Fig. 22.**

Like *P. speciosa* in stem and leaves, but apparently smaller, the leaves to 14 cm. wide (so far as known), edges short-hairy, especially towards the apex; leaves purplish

beneath (when young only ?). *Inflorescence* axis to about 5 cm. long, diameter of flowering part 7–8 cm., the *involucral bracts* forming a shallow cup, their ends spreading, broad to the apex, which is not reflexed, about 6 cm. long and to 4 cm. wide, dark red with pale greenish edges. *Flowering bracts* c. 3·5 cm. long and 1 cm. wide, red with pale green edges. *Bracteole* 2·5 cm. long, translucent, tinged with red. *Ovary* finely appressed-hairy. *Calyx* 3·5 cm. long, red, with 3 greenish tips about 2 mm. long, the other side split about 1·5 cm. *Corolla-tube* white; lobes 8 mm. longer than calyx, red with translucent whitish edges. *Lip* deep red with yellow edges all round except towards the base, 5 mm. longer than the corolla-lobes. *Filament* 4 mm. long, white; anther 9 mm. long, crimson on back. *Stigma* large, shining, crimson. *Fruiting-head* 12 cm. across; fruits short-hairy, long-beaked, about 5 cm. long, diameter in the middle about 2·5 cm. (when dry—probably more when fresh), beak 1·5 cm. long, surmounted by remains of calyx.

This species is known from few collections; it is in cultivation in Singapore. It is distinguished by its broad, shortly spreading dark red involucral bracts and long-beaked fruits. About 12 flowers open together, in the early morning.

SPECIMENS. *Perak.* Larut Hills (plant cult. in Singapore), Ridley 6887 (Type). Maxwell's Hill, Ridley s.n. June 1893. *Trengganu.* Ulu Brang, 400 feet, S.F.N. 33670 (Moysey).

3. **Phaeomeria speciosa** (Bl.) Merrill, Enum. Philip. Pl. 1: 241. 1922. *Elettaria speciosa* Bl., Enum. Pl. Jav. 51. 1827. *Alpinia magnifica* Roscoe, Monandr. Pl. t. 75. 1828. *Phaeomeria imperialis* Lindl., Nat. Syst. Ed. 2,446. 1836. Ridl., Flora 4: 272. *Nicolaia imperialis* Horan., Monogr. 32, t. 1. 1862. *Nicolaia speciosa* Horan., Monogr. 32. 1862. Valet., Bull. Buitenz. 3rd Ser. 3: 138. 1921. *Phaeomeria magnifica* K. Schum., Pflanzenr. Zingib. 262. 1904.

Leafy stems close together, to about 5 m. tall, with about 18 pairs of leaves; uppermost leaves often narrow, subapical largest. *Largest leaves* to about 85 by 18 cm., glabrous, purplish beneath when young, tip short, edges broadly crisped, base very broadly rounded or in the lowest leaves slightly cordate; *petiole* to 4 cm. long; *ligule* slightly bilobed, to 1·5 cm. long, glabrous. *Scape* about 120–150 cm. tall; sheaths glabrous, to 12 cm. long, not overlapping, green. *Involucral bracts* about 8–12 cm. long and 2–3 cm. wide (a few outer ones shorter and broader), the ends more or less tapering, spreading with the ends reflexed at flowering, waxy, crimson-pink with pale edges, the ends with a short (2–3 mm. long) spine-like appendage below the apex. *Axis* of inflorescence elongating to 5–10 cm. or more. *Floral bracts:* outer ones showing a transition from the involucral bracts, inner ones smaller 3·5–5 cm. long, narrow, pink. *Bracteoles* about 2·2 cm. long, deeply split. *Calyx* 3 cm. or rather more long, 3-toothed,

the teeth close together, the other side of the tube rather deeply split. *Corolla* normal for genus, lobes pink. *Lip* deep crimson with narrow white or yellow edges. *Filament* short, flat, white-hairy; anther longer, red. *Heads of fruits* about 10 cm. diameter and up to 10 cm. or more long; individual fruits rounded, 2–2·5 cm. diameter, narrowed to base and rounded at apex, short-hairy, green to reddish; seeds many, black in a translucent pulp.

This species appears to be widely distributed in Malaysia, and is often cultivated for its flower-shoots. Valeton says there are several varieties. Ridley says that the wild Malayan plants have a yellow-edged lip, while cultivated ones are white-edged. There is said to be a variety with the leaves permanently dark purple beneath.

Though this species has been known for over a century, no full description with accurate details of flowers has been published, and as no fresh flowers or specimens in alcohol are available, the dimensions given have not been checked.

4. **Phaeomeria venusta** (Ridl.) K. Schum., Pflanzenr. Zingib. 264. 1904. Ridl., Flora 4: 272. *Hornstedtia venusta* Ridl., J.S.B.R.A.S. 32: 149. 1899.

Rhizome at or just above ground level; *leafy shoots* rather close together, 3–4 m. tall. *Leaves* green, purple beneath when young, to at least 80 by 19 cm., edges short-hairy, base rather gradually narrowed, cuneate to rounded; *petiole* 0–3 cm. long; *ligule* short-hairy, bilobed, to 2 cm. long. *Inflorescence* about 60 cm. tall; *peduncle* short-hairy, its sheaths to 10 cm. long, not overlapping, pale green. *Inflorescence* at flowering 5 cm. or more in diameter, the receptacle broad and only slightly raised in the middle. *Involucral bracts* about 7 by 2·5 to 12 by 4 cm., erect, forming a cup, bright rose-pink, the largest outer ones with recurved ends. *Floral bracts* about 4 cm. long, narrow, pale pink or white. *Bracteoles* tubular at base, unequally 2-lobed at apex, deeply split, c. 3·5 cm. long, whitish. *Ovary* appressed-hairy. *Calyx* about 5 cm. long, narrowly tubular, pink with white tip, the three teeth very short and close together, the other side split 2 cm. or more, appressed-hairy especially near base. *Corolla-tube* about 2·5 cm., lobes about 2·5 cm. long (the whole corolla thus equal in length to calyx); lobes pink to crimson, about 6 mm. wide near the base, their tips round and concave, slightly spreading. *Lip* when straightened about 4 mm. longer than corolla-lobes, when flattened ovate, the sides towards the base raised, their edges touching behind the stamen, edges white or pale yellowish, centre crimson, apex rounded, slightly reflexed, 5 mm. wide. *Filament* about 3 mm. long (free part), white-hairy; *anther* massive, 1·1 cm. long, retuse at the apex, white or pink, with yellowish hairs on the pollen-sacs. *Stigma* large, 3·5 mm. across the apex, filling the retuse apex of the anther, the mouth narrow, fringed with hairs. *Stylodes* 5 mm. long, broad, surrounding the base of the style, split to the base on one side, irregularly warty near the shortly pointed apices. *Floral tube* with a ring of hairs at the level of junction of

corolla and lip with anther. *Fruiting-head* about 12 cm. across, fruits red, beaked about as in *P. fulgens*, sessile, glabrous.

The details of colour are taken from a drawing made of a plant cultivated at Penang and from Corner's field notes (on S.F.N. 32778). Ridley's original description agrees except that he says the calyx is red, and the lip spotted with pink.

SPECIMENS. *Selangor.* Ginting Bidai, Ridley 7810 (Type). *Perak.* Ulu Batang Padang, Ridley 13835. Taiping Hills, Tea Gardens, Curtis s.n. May 1890. *Trengganu.* Ulu Brang, 300 feet, S.F.N. 33721 (Moysey). *Johore.* Mawai-Jemaluang Road, S.F.N. 32778 (Corner).

8. ACHASMA GRIFFITH

Rhizome of long elements between leaf-shoots, relatively slender, often rather deep, never much raised above ground. *Ligule* simple. *Inflorescence* capitate or cylindric, on a short erect subterranean stalk covered with short 2-ranked sheaths which increase in length from base to apex of stalk. *Involucral bracts* 2–8, whitish or coloured, much broader than the inner floral bracts. *Flowers* on a flat receptacle, 4–15 open together (except in species which have only 2–3 flowers), in 3 or 4 concentric circles. *Floral bracts* with one flower to each, the inner ones narrow, the outer ones often wider and showing a transition to the involucral bracts. *Bracteole* one to each flower, tubular at the base, the upper part sheathing, 2 or 3-toothed. *Calyx* tubular, rather long, split down one side to about 1/3 of its length, with 3 short teeth on the other side. *Corolla-tube* nearly as long as calyx, lobes erect, much shorter than tube, dorsal lobe not hooded, somewhat wider than the others, which are ± folded beneath it or close to it on either side. *Labellum* very long; lowest part erect, forming a broad tube with the base of the stamen for some distance above the junction of the corolla-lobes; free part ± 3-lobed, the lateral lobes at the base folded over the stamen, more distally reflexed, the midlobe widening from a narrow base and spreading horizontally, its apex entire or bilobed: after the flower withers, the lower part of the labellum is rolled spirally inwards as in Phaeomeria, the widened blade withering. *Staminodes* none. *Stylodes* narrow or flattened, pointed. *Stamen:* filament (free part) very short, erect, rather broad; anther bent forwards, massive, at apex more or less deeply cleft, never crested. *Fruits* sessile, in a round compact head, not dehiscent, the pericarp thick and dry, smooth on the outside or ± longitudinally ridged, or with blunt warts in rows, towards the rounded apex.

The genus Achasma was founded by Griffith, the descriptions and drawings being published in his *Notulae* in 1851. He described three species, all apparently found in Malaya, though the locality of one (*A. metriocheilos*) is not specified. Unfortunately he failed to give any vegetative details, and the floral details also are not always very explicit. Apparently his drawings were made from flowers preserved in alcohol, and his colour notes are incomplete. *A. metriocheilos* remains a doubtful species.

Griffith at the same time described another genus *Stenochasma,* which he contrasted with Achasma. His Stenochasma is identical with Hornstedtia, and the name is thus superfluous; but his Achasma is a group which up to that time had not been recognized as a distinct genus. Blume had described some species from Java, but he had included them as a section in the genus Elettaria. Like Griffith, Blume had recognized the difference between Hornstedtia and Achasma; for the former he used the generic name Donacodes (see Valeton, Bull. Inst. Bot. Buit. XX. 1904).

Baker, in the Flora of British India, reverted to a broad concept of the genus Amomum, and included in it Hornstedtia and Achasma as sections. Ridley removed them, with Phaeomeria, and united them under the name Hornstedtia and in this he was followed by Schumann, who however separated Phaeomeria.

Valeton then began his studies of a large number of living plants in Java, and pointed out the striking differences between Achasma and Hornstedtia, showing that Achasma is really more nearly related to Phaeomeria. He usually retained the name Amomum for the species of Achasma, perhaps pending a full revision of the genera which he hoped to make later. It is clear from his work that to unite Achasma with Hornstedtia while separating Phaeomeria is unjustifiable. I think however that *Hornstedtia leonurus* provides a link between Achasma and Hornstedtia which Valeton did not know of; and that the three genera are more nearly related together than any of them is to Amomum.

Achasma inflorescences are very distinct in their long horizontally spreading lips, with blade nearly always widening from its base, the petals being much shorter than the lip. The involucral bracts are usually less stiff than in Hornstedtia, and have a wider opening, 4–12 flowers being open simultaneously (except in the species with very small inflorescences). In this they resemble Phaeomeria, the flowers of which open many together in concentric circles. Achasma inflorescences are however always partly embedded in the earth whereas those of Phaeomeria are raised

well above ground level. Another resemblance between Achasma and Phaeomeria is the stiff inrolling of the fleshy base of the lip as the flower withers. This does not occur in Hornstedtia.

There are two distinct flower-types in Malayan Achasmas. In one the sepals and petals are about equal in length, the petals narrow; in the other the petals are much longer and wider, hooded over the base of the lip. Combined with this difference is one of colour; in the first flower-type the lip is entirely red, or has the edges only yellow or white towards the base; in the second type the edges are always red, the middle towards the base being often yellow. The stigma is crimson or nearly black in the first type, and almost white in the second. (The species *A. triorgyale* may represent a third type; full details are lacking). It would be possible to include all Malayan plants at present known, except perhaps those of *A. triorgyale*, in two species corresponding to these two flower-types; but these species would both show much variation. It seems clear that the red sheaths and young leaves of *A. sphaerocephalum* are correlated with deep red bracts and white-edged lip, and thus it may reasonably rank as a separate species; its varieties, as here recognized, are less clearly distinct, and need more field study. The two species with quite subterranean inflorescences belong one to each flower-type. Such inflorescences might occur owing merely to the accidental condition of the rhizome being unusually deep in the soil; but they appear to be constant in localities where the normal types also occur, and they are probably quite distinct. There is evidence of yet a third subterranean species, allied to *A. megalocheilos*. Further field study is needed, and may establish more distinct forms than are here recognized. Old collections are often difficult to identify with certainty, owing to the unsatisfactory preservation of the flowers. Recent collections, including alcohol material and field notes of colour, and cultivated plants, are the main basis of the present account.

KEY TO THE MALAYAN SPECIES OF ACHASMA

Involucral bracts to about 8 by 5 cm., the inner ones about as long as the calyx of the flowers 1. *A. triorgyale.*
Involucral bracts not usually over 2·5 cm. wide, the inner ones sometimes distinctly shorter than the calyx
Flowers 1–3 (rarely 5) on each inflorescence, the bracts entirely below ground level
Petals much longer than calyx, the dorsal petal about 1 cm. wide; middle of base of lip yellow, rest red 2. *A. pauciflorum.*

Petals about same length as calyx, the dorsal petal about 5 mm. wide; edges of lip towards base white, rest red 3. *A. subterraneum.*

Flowers many more in each inflorescence, the bracts partly emerging above ground

Petals much longer than calyx, the dorsal one 1 cm. wide; lip yellow in the middle towards the base, rest red 4. *A. macrocheilos.*

Petals about same length as calyx, the dorsal one about 5 mm. wide; lip entirely red, or with white or yellow edges towards the base, not yellow in the centre

Edges of lip white; young leaves purplish beneath and sometimes with red bars above; petioles usually short or wanting 5. *A. sphaerocephalum.*

Edges of lip yellow, orange or same colour as rest of lip; young leaves green beneath; petioles 3–4·5 cm. long 6. *A. megalocheilos.*

1. **Achasma triorgyale** (Bak.) Holtt., **comb. nov.** *Amomum triorgyale* Bak., F.B.I. 6: 237. 1892. *Hornstedtia triorgyalis* Ridl., J.S.B.R.A.S. 32: 144. 1899. Flora 4: 269.

Leafy stems to c. 5 m. or more tall, sheaths glabrous or short-hairy. *Leaves* to 80 by 18 cm., apex very shortly pointed, base cuneate, unequal, usually softly short-hairy throughout on lower surface, sometimes glabrescent; petiole 2–2·5 cm. long, ligule c. 2·5 cm. long, densely short-hairy. *Inflorescences* about 10 cm. high and not quite so wide: scape apparently short. *Involucral bracts* about 8, oblong, deep rose, to about 8 by 5 cm., short appressed-hairy throughout or towards base only, the apex very broad, the stiff point very short, the inner ones as long as the calyces of the flowers. *Floral* bracts pale with pink tips, to about 8 by 1·7 cm., silky-hairy towards base. *Bracteoles* 5·5–6 cm. long. *Calyx* 7·5–8 cm. long, red. *Corolla-lobes* about 7 mm. (?) longer than calyx, dorsal largest, and rounded, c. 5 mm. wide, cherry red. *Lip* 2·5–3 cm. longer than corolla, cherry red to scarlet, the blade widening much from its base, about 1·5 cm. wide or more, tip rounded entire. *Anther* c. 9 mm. long. *Fruit* not known.

SPECIMENS. *Perak.* Larut, below 300 feet alt., King's Collector 2105 (Type). Ipoh, foot of limestone rocks Curtis 3317. Temango, Ridley 14420. G. Pondok, on the earth slope leading up to the cliffs, S.F.N. 13903 (Burkill). *Selangor.* Ginting Peras, Ridley 7806.

Baker described this species as having the lip as long as the corolla segments; but this is not the case in the specimen of the type collection in the Singapore herbarium, which is a typical Achasma. The very broad bracts are distinctive. Floral details are taken from a plant in the Singapore Botanic Gardens.

2. **Achasma pauciflorum** (Ridl.) Holtt., **comb. nov.** *Hornstedtia pauciflora* Ridl., J.S.B.R.A.S. 32: 144. 1899. Flora 4: 270.

Leafy stems widely spaced, 3–4 m. tall, basal part covered with sheaths green or slightly yellowing. *Leaves* green throughout, to about 60 by 12–15 cm., shortly pointed, base cuneate, unequal; lower surface hairy along edges, the rest glabrous or with short soft hairs all over; petiole 0–1·5 cm. (sometimes nil on one side, 1 cm. on the other); ligule 1–2·5 cm., ± hairy, always so at edges when young. *Inflorescence* arising from rhizome up to 15 cm. below surface of ground; scape slender, covered with overlapping bracts increasing in size upwards, 2–6 cm. long. Inflorescence very narrow, bearing 1–3 (rarely 5) flowers, the bracts completely immersed in the soil. *Involucral bracts* few, to about 6 cm. long and 1·2 cm wide, white, rather thin, apex pointed. *Floral bracts* 5–6 cm. long, narrow, thin (sometimes shorter). *Bracteole* c. 4–5 cm. long. *Calyx* c. 5–7 cm. long, pale pink or red at tip. *Corolla* 2–2·5 cm. longer than calyx, hooded over base of lip, deep rose-pink to rose-red, dorsal lobe 1·2 cm. wide. *Lip:* base yellow with scarlet edge, blade orange-red, c. 1·5 cm. wide, edges more or less crinkled, apex entire or retuse; total length of lip 5–6 cm. *Stamen:* filament 3–4 mm. broad, 3–4 mm. long: anther bent at an angle to filament, 8–9 mm. long, short-hairy towards base only. *Style* pale yellowish, stigma white or pale pink.

This species is not distinguishable in flower structure from *A. macrocheilos*. The only clear difference is in the inflorescence with bracts entirely below ground level, and few flowers in an inflorescence. The ligule in specimens found is rather long but this may not be a constant character. The length of bracts and calyx varies with depth of the inflorescence. *A. pauciflorum* has been found at three quite distinct localities and the specimens agree well together. In two cases it was recorded as common. It is therefore at least a quite distinct variety of *A. macrocheilos* and may be ranked as a separate species at present.

It is notable that similarly few-flowered immersed inflorescences have been found with flowers closely related to *A. megalocheilos* and *A. sphaerocephalum*.

Specimens. *Selangor.* Gua Batu, Ridley 8174 (Type). Upper Langat Valley, Holttum s.n. 1948, abundant. *Johore.* S. Segun, G. Panti, S.F.N. 30890 (Corner). Kota Tinggi, Holttum s.n. 1949, abundant. *Trengganu.* Ulu Kajang, Kemaman, 500 feet, S.F.N. 30430 (Corner).

3. **Achasma subterraneum** Holtt., **sp. nov.**

Caules foliati c. 300 cm. alti; *folia* ad 60 cm. longa et 12 cm. lata, subtus prope marginem et in costa basin versus pubescentia, apice breviter acuminata, basi inaequaliter cuneata; *petiolus* ad 2 cm. longus, subtus plus minusve pubescens; *ligula* ad 15 mm. longa, margine hirsuta. *Inflorescentiae* e ramis tenuibus subterraneis rhizomatis orientes; *scapus* tenuis, ad 20 cm. longus; *bracteae* involucri c. 3, 6–7

cm. longae, haud 1 cm. latae, tenues, acutae, toto subterraneae; *flores* c. 3; *bracteae* floreae eis involucri aequilongae sed angustiores, apice latiores, pubescentes; *bracteolae* 4·5 cm. longae; *calyx* c. 7·5 cm. longus, dentibus brevibus, pubescentibus; *corolla* calyce fere aequilonga, lobi 5 mm lati, apice rotundati; *labellum* rubrum, basin versus late albo-marginatum, 5–6 cm. longum, lamina 2 cm. lata; *filamentum* latum, 8 mm. longum; anthera 8 mm. longa, basin versus pubescens; *fructus* in solo maturescens, 3 cm. longus, 2·5 cm. latus, leviter pubescens, ellipsoideus vel pyriformis, apice late rotundatus, leviter umbonatus, non costatus. TYPUS: *Pahang*, Cameron Highlands, 5,000 feet, S.F.N. 31212, leg. Holttum, 13.5.1936. Also at Cameron Highlands, 4,600 feet, S.F.N. 23562 (Henderson).

This is like *A. sphaerocephalum* in flowers, but like *A. pauciflorum* in inflorescence. In leaf-characters it is rather between *A. sphaerocephalum* and *A. macrocheilos*, having a petiole of moderate length. Unfortunately the colour of the young leaves is not recorded. The fruits agree exactly with the fruits of *A. megalocheilos* as described in Java by Valeton (Ic. Bog. 2: t. 199), but are only 2 or 3 instead of 12 or more.

4. **Achasma macrocheilos** Griff., Notul. 3: 429, t. 357. 1851. *Amomum macrocheilos* Bak., F.B.I. 6: 235. 1892. *Hornstedtia macrocheilos* Ridl., J.S.B.R.A.S. 32: 147. 1899. Flora 4: 271. *Hornstedtia metriocheilos sensu* Ridl., J.S.B.R.S.A. 32: 147. 1899. Flora 4: 271 (not of Griffith).

Leafy stems widely spaced, 2–4 m. high, sheaths in basal part green or yellowish, sometimes slightly blotched with purple. *Leaves* to about 90 by 20 cm., sometimes only about 25 by 4 cm.; apex shortly pointed, *base* cuneate or slightly auricled; lower surface sometimes velvet-hairy; edges usually conspicuously brown-hairy beneath, towards the base sometimes densely hairy; petiole 5–15 mm. (sometimes to 3 cm.) long; ligule c. 1–2·5 cm. long, usually hairy and sometimes densely so but sometimes glabrescent. *Inflorescence* much longer than wide, half immersed, close to base of leafy shoot or not, peduncle usually short; up to 10 flowers open simultaneously. *Involucral bracts* where immersed whitish, the tips pale pinkish or greenish where above ground, about 8, 5–7·5 cm. long and to 2·5 cm. wide, apex of outer bracts with a stiff point. *Floral bracts* narrower (inner ones c. 4 cm. long and 8 mm. wide). *Bracteole* 3·5–4 cm. long, pale pink, tawny-hairy near apex. *Calyx* with ovary c. 6–7 cm. long, pale pink, apical part deeper in colour and sparsely tawny-hairy. *Corolla* in all c. 2 cm. longer than calyx (tube shorter than calyx), the dorsal lobe narrowed to a blunt tip, 25 mm. long and c. 10–12 mm. wide, covering base of lip and about as long as the stamen, rose-red, the others about 22 mm. long and 7·5 mm. wide, more or less folded beneath it on either side. *Tube* above top of corolla-tube to junction of lip and stamen 16 mm. long, very pale pink. *Lip* to about 5 cm. long, the blade retuse or more or less deeply 2-lobed, with more or less

crinkled edges; blade scarlet or orange-red or streaked with yellow, the basal part yellow with red edges, a yellow median line sometimes extending on to the blade. *Anther* red, c. 7–8 mm. long, the filament c. 2–5 (?) mm. long; anther at a right angle to filament (bent forwards), slightly hairy at base only. *Stigma* white or pink. *Fruit* unknown: in *A. coccineum* it is ridged longitudinally towards apex.

A common species on edges of forest and near forest streams in lowlands throughout Malaya. This is very near *Achasma coccineum* (Bl.) Valeton from Java (Ic. Bog. 2: t. 156, 157), and the two should probably be united. There seems to be some variation in flowers of Malayan plants, in width and depth of lobing of midlobe of lip. Ridley has called these plants mostly *A. metriocheilos* Griff., but that species has rather short involucral bracts, and there is no proper information about colour, nor about relative length of calyx and corolla. The drawing of *A. metriocheilos* might pass as *A. sphaerocephalum*, but one cannot certainly identify it as such. The only thing one can say with certainty is that Ridley's plants so named are much more like *A. macrocheilos* in shape of inflorescence, bracts and flower, but mostly have a wider lip less deeply cleft, with the lobes more rounded than shown by Griffith. Valeton figures *Achasma Walang* (Bl.) from Java (Ic. Bog. 2: t. 162, fig. 1–9); this has a narrow deeply cleft and crinkled lip, but the other characters do not well fit the Malayan plants of which we have good information. The thin parts of the lip are very delicate and soon shrivel; this would account for some discrepancy. Therefore our conclusion is that *A. macrocheilos* is variable in the details of the lip, the essential characters being: rather narrow inflorescence with long bracts, corolla with wide lobes much longer than calyx, and lip yellow in the middle towards the base, rest scarlet (or sometimes streaked with yellow). The leaves on a single shoot may differ in hairiness, and there is much difference in this character between different herbarium specimens.

5. **Achasma sphaerocephalum** (Bak.) Holtt., **comb. nov.** *Amomum sphaerocephalum* Bak., F.B.I. 6: 234. 1892. *Hornstedtia sphaerocephala* K. Schum., Pflanzenr. Zingib. 192. 1904. *Hornstedtia albomarginata* Ridl., J.S.B.R.A.S. 32: 145. 1899. Flora 4: 269.

Leafy shoots rather distant, 2–4 m. tall, sheaths of leaves ± reddish. *Leaves* to about 80 by 15 cm., apex with short narrow tip, base unequal, rounded except sometimes in uppermost leaves; lower surface usually softly short-hairy all over but sometimes almost glabrous; when young flushed purple-pink beneath and sometimes with pairs of dull red oblique bars on the upper surface, entirely green when old; petiole usually 0–5 mm. long (in var. *petiolata* longer), ligule usually

about 7–12 mm. long (in var. *petiolata* longer), hairy, at least on the edge. *Inflorescences* from a rhizome often rather deep in the earth, (to 15 cm.), usually at some distance from a leafy shoot; basal part only of involucral bracts buried in the ground. *Scape* slender, with 2-ranked overlapping acute sheaths to about 3 cm. long. *Involucral* bracts to about 8, the exposed parts deep crimson, 2·5 cm. long, usually not much over 1 cm. wide (exceptionally to 2 cm. wide), shortly pointed. *Floral bracts* narrow, 4–5 cm. long, widest near hairy apex, red, the outer ones wider and grading into the involucre. *Bracteoles* 2·8–3·5 cm. long, crimson, apex usually 2-lobed, hairy. *Calyx* 5·5–6·5 cm. long, split about 2·5 cm. down one side, 3-toothed, the teeth short, white-hairy, pink to crimson. *Corolla* in all little or not longer than the calyx, the lobes about 2 cm. long and 5 mm. wide, ends rounded, short-hairy, pink, sometimes crimson at the apex. *Lip* 3·5–6 cm. long, the blade 1·5–2·7 cm. wide, the apex retuse or cleft as much as 1 cm. into two rounded lobes; base of lip deep crimson, the recurved edges white; the blade lighter in colour than the base. *Stamen:* filament about 4–7 mm. long; anther 8–9 mm. long, rose-red, hairy on the pollen-sacs towards the base. *Stigma* very dark crimson, style pink. *Fruiting-head* c. 8 cm. diameter, sunk in ground, fruits obovoid, smooth, hairy, to 4 cm. long and 2·5 cm. diameter (seen only in Ridley s.n. Maxwell's Hill June 1893).

var. rubrostriatum Holtt., **var. nov.**

Caules foliati 200 cm. paulo superantes; folia ad 50 × 8 cm., in juventute supra striis obliquis rubris 5–8 mm. latis ornata; labellum c. 5 cm. longum, 1·7 cm. latum, apice bilobatum; lamina labelli atrorosea, interdum medio aurantiaco-suffusa.

SPECIMEN. *Selangor:* near the Gap, alt. 1,000 feet, S.F.N. 30776 (Corner).

Ridley gives the character of red-barred leaves in his description of *H. albomarginata,* but there is no information as to colour of leaves with any herbarium specimen except Corner's; and the excellent drawing of *H. albomarginata* (plant from Penang) shows no red bars, though it does show the pink flush on the under surface. Whether the red-bar character is confined to small plants we do not know.

var. majus Holtt., **var. nov.**

Caules foliati ad 4 m. alti; folia ad 80 × 15 cm., basi cuneata, infra hirsuta et in juventute pallide purpureo-suffusa; petioli ad 5 mm. longi; ligula 12 mm. longa, hirsutissima; labellum 3·5 cm. longum, lamina rosea lucida c. 13 mm. lata.

SPECIMEN. *Trengganu.* Bukit Kajang, Kemaman, 500 feet, S.F.N. 30205 (Corner).

The majority of collections assigned to this species agree vegetatively with this variety; but for most of them details of the lip are lacking.

var. **petiolatum** Holtt., var. nov.

Caules foliati ad 6 m. alti; folia subglabra; petioli 2·5–3 cm. longi; ligula ad 2·5 cm. longa, fere glabra; flores eis var. majoris similes.

SPECIMENS. *Johore.* Ulu Segun, G. Panti, 800 feet, S.F.N. 30745 (Corner). *Perak.* G. Keledang, Ridley 9575.

In vegetative characters this is very near *A. megalocheilos,* but the lip (in Corner's specimen) is smaller and has white edges, and the leaves are pinkish beneath when young.

var. **grandiflorum** Holtt., var. nov.

Caules foliati 2–2·5 m. alti; folia ad 65 × 10 cm. (inferiora ad 14 cm. lata), in juventute infra purpurea; labellum 6 cm. longum vel ultra, lamina labelli 2·7 cm. lata, coccinea.

SPECIMEN. *Trengganu:* Bukit Kajang, Kemaman, 600 feet, S.F.N. 30234 (Corner).

The type of the species is a specimen of Maingay's from Penang: this is recorded as having white edges to the lip, and the blade as rather deeply cleft. It may have been var. *rubrostriata* as described above.

The essential characters of the species are: (1) the pink lower surface of young leaves and of leaf-sheaths, (2) the white edges and deep crimson base of the lip, (3) the corolla about as long as the calyx, with narrow lobes, (4) the deep red involucral bracts which are distinctly shorter than the calyces of the flowers.

It is possible that this species is identical with *Achasma metriocheilos* Griff. (Ic. Pl. Asiat. t. 356) but the details given by Griffith are not adequate to decide with certainty. It seems better therefore to ignore Griffith's name.

A. sphaerocephalum has been found in many parts of Malaya, in forest in the lowlands, often abundant, and at moderate elevations on the mountains. It has not been described as occurring in neighbouring countries.

6. **Achasma megalocheilos** Griff., Notul. 3: 426, t. 355. 1851. Valet., Ic. Bog. 2: t. 188, 199. 1903. *Hornstedtia megalocheilos* Ridl., J.S.B.R.A.S. 32: 146. 1899. Flora 4: 270. *Amomum megalocheilos* Bak., F.B.I. 6: 236. 1892. **Fig. 23.**

Leafy shoots 3–6 m. tall, the sheaths on basal part of stem green. *Leaves* to about 90 by 12 cm., apex very shortly tipped (usually about 1 cm.), base often unequal, broadly cuneate to truncate, slightly decurrent on petiole; petiole 3–4·5 cm. long, blade softly short-hairy beneath, or on midrib only, or glabrous; ligule to about 2 cm. long, glabrous or short-hairy. *Inflorescence* with basal ¼–½ of involucre immersed in earth, usually near a leafy stem (sometimes to 50 cm. away); peduncle to about 10 cm. long (often much less) covered with overlapping sheaths in 2 ranks, the upper grading

to the involucral bracts; 4–12 flowers open at once. *Involucral bracts* about 8, to about 6 by 3 cm., where underground white or pale pink, where exposed crimson, shining, the outer ones at least with a short stiff point. *Floral bracts:* outer ones to 7 by 2·8 cm. (their tips seen above sterile ones), inner gradually narrower. *Bracteoles* c. 5–6 cm. long. *Calyx* c. 7–8 cm. long, pale pink, or with deeper coloured tips. *Corolla* about same length as calyx, the tube white, the lobes pink, about 3 cm. long and 5 mm. wide, rounded at the tips, slightly hairy at tips. *Lip* 5–6 cm. long, the blade about 2 cm. wide, entire or more or less cleft at the apex, flame colour or scarlet with the edges towards the base yellow, orange or concolourous with the rest, the yellow edges sometimes extending as a narrow border on to the midlobe. *Stylodes* flat, 6 mm. long, shortly pointed, cream, quite free to the base, not enclosing base of style. *Stamen:* filament white or pale pink, anther rose-pink, about 8 mm. long, as long as free part of filament. *Stigma* bright carmine, large, bent back above the anther, the narrow aperture facing forwards. *Fruit:* head usually of 12–20 fruits close together, the whole 8 cm. diameter; each fruit unevenly many-sided due to lateral pressure, the apex broadly rounded, smooth and slightly short-hairy, not ridged, c. 2·5 cm. diameter.

Distribution: Java; Malaya, throughout in lowlands.

The distinctive features are: usually large size, leaves with long stalks, never pink beneath; inflorescence with fairly long involucral bracts; calyx and corolla about equal; lip rather large with usually (not always) yellow margin towards base. Lips of various colour are found on plants near together.

Nearly allied to *A. sphaerocephalum,* differing in always long-stalked leaves never pink beneath, paler longer involucral bracts, yellow-edged, more orange-scarlet always large lip, and bright red stigma.

A specimen collected by Burkill at Sungei Pertang, Bentong, Pahang (S.F.N. 16515) has inflorescences entirely in the soil as in *A. pauciflorum,* but with flowers entirely scarlet and large leaves with long petioles: perhaps a distinct variety.

9. AMOMUM

Rhizome just below surface of ground, or sometimes supported above ground-level on stilt-roots, never very thick; intervals between leaf-shoots short to fairly long. *Leafy shoots* 1–3 m. tall. Leaves several to many, the lower 1/3 of the shoot covered with sheaths only. *Ligule* moderately large, broad, not or hardly lobed. *Inflorescence* sometimes with its base embedded in the ground, on a short or fairly short peduncle from the rhizome; axis of inflorescence elongating during flowering, sometimes to as much as 20 cm. or more, with a succession of few to many flowers, a few opening together; bracts all similar and fairly large;

no involucre of sterile bracts at the base, but the two uppermost sheaths of the peduncle often enclosing the base of the inflorescence. *Bracts* persistent to fruiting or sometimes quickly disintegrating. *Bracteoles* usually tubular, short, 2-lobed, in two species rather long and split to the base. *Calyx* tubular, usually unequally 3-lobed. *Corolla-tube* about as long as calyx, or up to 50 per cent longer; lobes usually about as long as tube, the upper broadest, concave and hooded towards the apex, at an angle to the lip or near it and forming a bell or funnel-shaped flower, or erect, the laterals narrower, usually appressed to the lip on either side near its edges. *Labellum* somewhat longer than the corolla-lobes, usually obovate, widening from a narrow base, the sides erect or convolute towards the base, the apex spreading and sometimes reflexed, usually yellow or orange in the centre, with some red veins or marks, the sides often white. *Staminodes* small, narrow, or absent. *Stamen* half or 3/4 as long as lip, filament and anther of about equal length, connective produced beyond apex of pollen-sacs into a crest which is usually 3-lobed, the lateral lobes spreading more or less widely but in two species simple and hardly spreading. *Fruit* a capsule or berry; capsule smooth or slightly ridged, sessile and covered with persistent bracts in a compact infructescence; if a berry, usually stalked, covered with fleshy spines, and in a more or less lax infructescence which sometimes elongates, the bracts often disintegrating.

The important distinguishing characters of Amomum are the absence of an involucre of sterile bracts, the usually elongating inflorescence, the uniform, fairly large and often persistent but never very thick floral bracts, the usually tubular bracteole, the broad concave lip, yellow and white with small red markings, not greatly longer than the corolla-lobes, and the crested anther. The crest of the anther is usually thin, and distinctly 3-lobed. In two species the lateral lobes are narrow and spreading. In two other species the crest is simple, hardly spreading laterally, and is hooded over the stigma.

The two types of fruit are very distinct, one smooth and thin-walled, dry at maturity, at most ridged, the other a fleshy spiny berry, in some species rather like a small Rambutan in appearance. Seeds of several species of Amomum are used in a subsidiary way as spices, having a flavour similar to that of Cardamons, but none of the wild Malayan species is of much value in this way. At Cameron Highlands, the Indian species *A. subulatum* is cultivated by immigrant Indians employed on tea estates and elsewhere. Its seeds are much used as a spice in India. The

species is easily recognized by the long slender points of bracts, calyx and corolla-lobes. It has a rather massive club-shaped inflorescence.

The species *A. spiceum* and *A. xanthophlebium,* both of which have large 3-lobed bracteoles not tubular at the base and much longer than the calyx, and also narrow (but not terete) horn-like appendages at the apex of the anther, constitute at first sight a very distinct section, which might well be separated generically from the other species. But closely similar in general appearance to *A. spiceum* is *A. utriculosum;* and this has the bracteole quite tubular, longer than the calyx as in *A. spiceum,* with a rather similar horned anther. Clearly allied to this are two species with much smaller bracts, again with tubular bracteole longer than the calyx and horned anther (*A. citrinum* and *A. squarrosum*). It seems probable that *A. spiceum* and *A. xanthophebium* are derived from the *A. utriculosum* group, to which they are so similar in all characters except the split bracteole that they could hardly be generically separated. The situation is further complicated by *A. macroglossa,* which in stilt-roots and bracts resembles *A. squarrosum* but has the calyx longer than the bracteole and the anther-crest much reduced.

A. biflorum Jack has very reduced inflorescences, of two or three flowers each, but is in other respects typical of the genus. It certainly does not belong to Elettariopsis; still less is it related to *Elettaria longituba,* with which it was classed generically by Ridley.

In essential floral structure, Amomum is very near Alpinia. It may be regarded as derived from Alpinia by the development of separate short shoots for the flowers, with 2-ranked bladeless sheaths instead of leaves, by a relatively larger development of the primary bracts, and by a reduction of each cincinnus to a single flower and a single bract (now a bracteole). There is no known case in Amomum in which more than one flower occurs in the axil of a primary bract; but in view of the existence of *Hornstedtia leonurus,* one must be prepared for such a possibility.

On this interpretation, the only Malayan genera which one can reasonably regard as derivatives of Amomum are Elettariopsis and Plagiostachys. The former is specialized in having a branched horizontal inflorescence, the branches bearing long-tubed flowers just below the surface of the ground, and in having non-tubular bracteoles. Plagiostachys has a branched inflorescence differently borne, with suppression of the primary bracts. The colour of the labellum in both is very much as in Amomum. On the other hand, one could hardly imagine Elettaria, with

well-developed cincinni, having originated from a species of Amomum which had lost them. Perhaps Elettaria and Amomum had a common origin, but diverged from an early stage.

As regards Achasma, Phaeomeria and Hornstedtia, it is likely that they had a separate origin, different from that of Amomum, in the Alpinia stock, with similar reduction of the flowering stem and its leaves, and of the cincinni. That such reductions can easily occur on different lines is seen by their existence in other branches of the Zingiberaceae (e.g. in Costus).

There is no doubt that the name Amomum is not applicable to the present genus according to the Rules of Nomenclature; the case is fully set forth by Burkill in Kew Bulletin 1930, p. 32. But as Burkill points out, by far the simplest way out of the difficulty is to take Amomum in Roxburgh's sense, not that of Linnaeus, choosing one of Roxburgh's species (preferably *A. aculeatum*) as type species. Pending the regularizing of this procedure, or some other formal decision, the only reasonable course is to continue to use Amomum in the present sense. To attempt any other course would mean the changing of a great many names without any certainty that the changes will prove acceptable, and so further confuse the situation.

KEY TO THE SPECIES OF AMOMUM IN MALAYA

Bracts 5–7 cm. long: bracteole 3·5–5·5 cm. long, 3-lobed, split to the base; inflorescence elongating to about 12–20 cm.

Inflorescence long-cylindric, about 5 cm. diameter; bracts under 2 cm. wide 1. *A. spiceum.*

Inflorescence 8–9 cm. diameter; bracts over 2 cm. wide 2. *A. xanthophlebium.*

Bracts and bracteoles usually much smaller; bracteoles tubular at the base; inflorescence usually much shorter

Leafy stems to about 100 cm. tall; corolla-lobes about 8 mm. long; bracts about 1·5 cm. long

Inflorescences each of 2–3 flowers only 3. *A. biflorum.*

Inflorescences of several flowers

Ligule 5–6 cm. long 4. *A. macroglossa.*

Ligule 2–3 mm. long

Leaves to about 1·7 cm. wide 5. *A. micranthum.*

Leaves to about 7 cm. wide 6. *A. macrodous.*

Leafy stems taller; corolla-lobes 1·4 cm. or more long; bracts longer
- Corolla-tube 1½ times as long as calyx, or nearly so
  - Calyx 2·5 cm. long (including ovary), lip nearly 3 cm. long — 7. *A. hastilabium.*
  - Calyx 1·5 cm. long, lip much smaller
    - Inflorescence elongating to 17 cm.; leaves glabrous — 8. *A. cylindraceum.*
    - Inflorescence much shorter; leaves hairy beneath — 9. *A. rivale.*
- Corolla-tube not or little longer than calyx
  - Old inflorescence rather narrowly cylindric, with persistent bracts and smooth or slightly ribbed (never prickly) sessile fruits
    - Bracteole shorter than calyx — 10. *A. testaceum.*
    - Bracteole longer than calyx
      - Bracts about 2 cm. long
        - Bracts with thin brown edges; leaf hairy beneath; peduncle to 15 cm. long — 11. *A. squarrosum.*
        - Bracts firm, green; leaf glabrous; peduncle to 40 cm. — 12. *A. citrinum.*
      - Bracts 3–4·2 cm. long — 13. *A. utriculosum.*
  - Old inflorescences not narrowly cylindric; bracts usually not persistent, in some cases very short-lived; fruits prickly, stalked
    - Fruits to 4·5 cm. diameter, prickles scattered, short; petioles 1–3 cm. long — 14. *A. ochreum.*
    - Fruits smaller, densely prickly; petioles to 5 mm. long
      - Crest of anther simple, hardly wider than rest of anther
        - Ligule to 1 cm. long, midrib of leaf broad, shallowly channelled; inflorescence hardly elongating — 15. *A. cephalotes.*
        - Ligule to 3 mm. long, midrib narrow and rather deeply grooved; inflorescence elongating, often considerably, at fruiting — 16. *A. lappaceum.*

Crest of anther spreading considerably on either side, more or less lobed

Lip 2·5–3 cm. wide, orange-yellow with many small crimson marks, forming a closed cup with dorsal petal
17. *A. aculeatum*.

Lip 1·5 cm. wide, with yellow median band flanked by single crimson lines, widely separated from dorsal petal
18. *A. uliginosum*.

1. **Amomum spiceum** Ridl., J.S.B.R.A.S. 86: 309. 1922. Flora 4: 263.

Leafy shoots close together, about 2 m. tall. *Leaves* to about 60 cm. long, 2·5–4 cm. (? to 8 cm.) wide, narrowed gradually to apex (not caudate) and to base, glabrous; petiole to about 2 cm. long; ligule to about 1·5 cm. long, edges hairy. *Peduncle* to about 5 cm. (or to 20 cm.?) long, short-hairy. *Inflorescence* elongating to about 20 cm., slender, about 5 cm. diameter. *Bracts* apparently reddish, to about 6 cm. long, 1–1·7 cm. wide, elliptic, papery, the veins slightly raised, glabrous or short-hairy towards the base, the edges ± fringed with hairs when young. *Bracteole* shaped exactly as in *A. xanthophlebium*, 4 cm. long, edges fringed with hairs. *Ovary* densely hairy. *Calyx* 2·5 cm. long, hairy. *Corolla-tube* about as long as calyx; lobes dull red, about 2·5 cm. long, the upper one rather more than 1 cm. wide, hooded at the apex, at a small angle to the lip, lateral lobes narrower. *Lip* a little longer than corolla-lobes, broadly obovate, hardly lobed, the sides towards the base incurved and touching the dorsal corolla-lobe, the apex somewhat reflexed, yellow, with small red marks on either side of the middle near the base. *Filament* about 8 mm. long; anther 1 cm. long, narrow, with a curved narrow horn-like appendage about 6 mm. long on either side at the apex and a short rounded crest hooded over the stigma. *Staminodes* not seen. *Fruit* not seen.

This species is closely related to *A. xanthophlebium*, agreeing closely in the large papery bracts, peculiar bracteole and anther-crest. It differs strikingly in its narrow leaves and long rather slender inflorescence. As with *A. xanthophlebium*, the width of the bracts is very variable, even on specimens from the same locality. *A. spiceum* was first found in the neighbourhood of G. Angsi in Negri Sembilan, where it seems not uncommon.

A specimen from Pulau Tioman agrees with the Negri Sembilan plants, but has a leaf nearly 8 cm. wide and peduncles up to 20 cm. long. It is probably the same

species. The Negri Sembilan specimens have the peduncle cut off at the base, so that its full length is not known.

SPECIMENS. *Negri Sembilan.* Bukit Tangga, Ridley (Type, not seen). G. Angsi, 2,500 feet, S.F.N. 9911 (Holttum), 11612 (Md. Nur). *Pahang.* P. Tioman, G. Kajang 2,500 feet, S.F.N. 18934 (Md. Nur).

2. **Amomum xanthophlebium** Bak., F.B.I. 6: 241. 1892. Ridl., J.S.B.R.A.S. 32: 133. 1899. Flora 4: 262. *A. stenoglossum* Bak., F.B.I. 6: 234. 1892. K. Schum., Pflanzenr. Zingib. 251. 1904. **Fig. 24.**

Rhizome at or just below surface of ground; intervals between leaf-shoots to c. 15 cm. *Leafy shoots* to 5 m. tall, sheaths green, or yellowish-brown at base of stem. *Leaves* dark green, glabrous, to about 80 by 12 cm., apex shortly pointed, base cuneate, unequal; petiole 1–2·5 cm. long; ligule to about 1 cm. long, rounded, glabrous or short-hairy. *Peduncle* usually 10–15 cm., exceptionally to 40 cm. long, covered with overlapping sheaths. *Inflorescence* lengthening to about 12–24 cm., about 8–9 cm. diameter. *Bracts* variable, 5–7 cm. long, 2–4 cm. wide, deep red, thin, with narrow slightly raised longitudinal veins, outer surface glabrous or more or less persistently hairy, the hairs soft, appressed. *Bracteoles* 3·5–5·5 cm. long, not tubular, 3-lobed, the lobes to 2 cm. long, broadly pointed, outer surface appressed-hairy at least towards the base. *Calyx* 2–3·5 cm. long (including ovary), appressed-hairy, lobed to about 1/3 of its length. *Corolla-tube* about as long as calyx; lobes crimson; dorsal lobe to 2·5 cm. long and 2 cm. wide, concave, broadly rounded and slightly retuse at the apex, lateral lobes oblong, c. 8 mm. wide, ends rounded, on either side of lip; lobes and tube of corolla appressed-hairy or nearly glabrous outside. *Lip* to about 3·7 cm. long and 3·2 cm. wide, obovate, edges crinkled, white suffused with red, with red stripes and spots very closely set, and yellow stripes towards the apex (Corner's colour notes); translucent round spots (oil glands?) abundant, visible in dried lip. *Staminodes* whitish, on either side of base of lip, with rounded fleshy base c. 2·5 mm. long and wide, and straight subulate apex 2 mm. long (sometimes lacking?). *Anther* yellow, pollen-sacs c. 9 mm. long, the connective 3-lobed at the apex, lateral lobes oblong, curved, about 4 by 1·5 mm., with red tips, middle lobe curved over the stigma, oblong-rounded to triangular-rounded, to 4 mm. long and 3 mm. wide at the base. *Filament* fleshy, c. 2·5 mm. wide and 1 cm. long, pink. *Fruits* obovoid, c. 2 cm. long and 1·5 cm. wide, smooth, covered with appressed silky hairs.

This species is found in lowland forest in all parts of Malaya northwards to Perak and to 4,000 feet on the Main Range, being locally abundant. The large inflorescences and finely veined large dull red bracts are characteristic. There is a good deal of variation in the shape of the bracts, mountain plants having them usually wider than lowland ones, but there is no clear division into narrow and broad varieties. Mr. Ridley states that the flowers are used as

sambal in Malay curries; they are aromatic, as seen by the oil glands in the lip.

SPECIMENS. *Perak.* Bukit Segari, Dindings, Ridley 7225. Bujong Malacca, Ridley 9796. Pangkor, Ridley 7234. *Selangor.* Ulu Semangkok, Ridley 12106. *Negri Sembilan.* G. Tampin 1,200 feet, S.F.N. 2530 (Burkill). *Malacca.* Nyalas, Goodenough 1339. No locality, Alvins 563. *Pahang.* Boh Plantations, Cameron Highlands, S.F.N. 32864 (Md. Nur). Fraser's Hill, S.F.N. 33190 (Corner). *Johore.* Kota Tinggi, Ridley 15416. G. Pulai, Mat s.n. 1892. S. Pelepah Kiri, S.F.N. 33568 (Corner), 32493 (Corner). Sungei Kayu, S.F.N. 32180 (Ngadiman). *Singapore.* Bukit Mandai, Ridley s.n. 22.5. 1889 and 6544. S. Jurong, Ridley s.n. 16.1.1890. Chan Chu Kang, Ridley s.n. 1892. Bukit Panjang, Ridley s.n. 10.1.1889. Reformatory Road, Ridley s.n. 1908. Bajau, Ridley s.n. 1892. Seletar, Ridley 1658.

3. **Amomum biflorum** Jack, Mal. Misc. 1: 2. 1820. Bak., F.B.I. 6: 240. 1892. *Amomum Elettarioides* Bak., F.B.I. 6: 240. 1892. *Elettariopsis pubescens* Ridl., J.S.B.R.A.S. 32: 155. 1899. Flora 4: 275. *Amomum sp.*, Griff. Notul. 3: 417. *Elettariae sp.*, Griff. Ic. Pl. As. 3: pl. 252, f. 2. *Elettariopsis Schmidtii* K. Schum., Bot. Tidsskr. 24: 167. 1902. *Cyphostigma Schmidtii* K. Schum., Pflanzenr. Zingib. 274. 1904. *Amomum Schmidtii* Gagnep., Fl. Gen. Indoch. 6: 111. 1904.

Rhizome slender creeping covered when young with overlapping acute brown sheaths, internodes usually 2–2·5 cm. long; leafy shoots rather distant. *Leafy stems* (including leaves) about 100 cm. tall, leaves to about 6. *Leaf-blade* to about 35 by 7 cm., (largest leaf often about 25 by 5 cm.), softly short-hairy all over the lower surface or at least on the midrib towards the base; apex abruptly caudate (cauda 2–4 cm. long), usually widest 1/3 from apex and narrowed rather gradually to the cuneate base; petioles of lower leaves short, of upper leaves 1–2 cm. long; ligule to 5 mm. long, usually hairy but sometimes glabrescent. *Peduncles* arising at any node of the rhizome, usually 1–2 cm. long to the base of the flowering bracts, slender, covered with several short sheaths. *Inflorescences* usually of 2 or 3 flowers, each with a bract 2–2·5 cm. long. *Bracts* rather thin, acute, usually short-hairy but sometimes almost glabrous. *Bracteole* 1·3–1·5 cm. long, tubular, split 5 mm. down one side. *Calyx* 2·5–5 cm. long, unequally 3-toothed, hairy. *Corolla-tube* little longer than calyx, hairy; lobes c. 1·8 cm. long, dorsal one 6–7 mm. wide, laterals a little narrower, translucent, dorsal lobe erect, at 45° or more to lip. *Lip* about 2·8 cm. long and 2.2 cm. wide when flattened, erect, obovate, sides incurved at base on either side of the anther, distal half spreading, with the broad apex reflexed and turned under, slightly cleft in the middle, a median yellow band down the centre with red edges which widens towards the throat, rest white; median band fleshy and appressed hairy towards the base, with two raised keels. *Filament* about 7 mm. long and 3·5 mm. wide, attached at middle of back of anther. *Anther:* pollen-sacs under 5 mm. long: apical lobe of crest concave, rounded, reflexed at right angles to the pollen-sacs, about 2·5 mm. long and wide; lateral

lobes much smaller, spreading, bluntly triangular, under 2 mm. long. *Stigma* as large as dorsal lobe of the anther-crest and touching it, bent backwards at right angles to the style, fringed with hairs at the mouth, mouth linear, 2-lipped. *Stylodes* 6 mm. long, blunt, forming a tube round base of style, cleft to base down one side, slightly cleft on the other side.

There seems to be much variation in the length of the calyx of this species; perhaps the calyx length varies with the distance of its base from the ground surface. The structure and shape of the anther and stigma are almost exactly as in *Amomum kapulaga* Burk. and Sprague (*A. cardamomum* sensu Val., Ic. Bog. 2: t. 194) but the present species is smaller vegetatively, with much smaller inflorescences, but longer flowers and larger broader lip.

A. Schmidtii, found in the island of Koh Chang (Gulf of Siam) appears to be identical with this species. It is reported as having 4 flowers in an inflorescence.

SPECIMENS. *Setul.* Near Bukit Bunga, Ridley 14777. *Kedah.* Rawi, Ridley 15722. Burau Bay, Langkawi, Ridley 15798. *Penang.* Waterfall, Curtis 2276. Penara Bukit, Ridley 7236. Penang Gardens, Ridley 9332. Tulloh Bahang, Curtis s.n. Ap. 1900. *Malacca.* Gadek, S.F.N. 3391 (Burkill). Foot of Bukit Tampin, Goodenough 1933. *Pahang.* Tembeling, S.F.N. 24518 (Henderson). Joara Bay, P. Tioman, S.F.N. 967 (Burkill).

There is no doubt that this is a true Amomum, not an Elettariopsis as supposed by Ridley. The inflorescences arise direct from the rhizome, each on its own short peduncle, the flowering-heads very small, of 2 or 3 flowers only, but with bract and bracteole exactly as in typical Amomum. It is an even more reduced species than *A. gracile,* discussed by Valeton in Bull. Inst. Bot. Buit. XX: 18 and Ic. Bog. 2: t. 158.

4. **Amomum macroglossa** K. Schum., Engl. Jahrb. 27: 314. 1899. Pflanzenr. Zingib. 231. 1904.

Rhizome supported on stout stilt-roots to 20 cm. long, bearing leafy shoots about 2–5 cm. apart. *Stems* about 60–90 cm. to the top of the highest leaf-sheath. *Leaves* to about 12, the largest 30 cm. long and 4·5–6 cm. wide, subcoriaceous, quite smooth and glabrous, apex acuminate, base narrowly cuneate; petiole to 1·5 cm. long; ligule very thin, to 6 cm. long, entire, glabrous. *Inflorescence* from base of leafy shoots; *scape* decumbent at the base, curving upwards, the upper part erect, total length 6–12 cm., glabrous, almost entirely covered by the sheaths which increase in size from the base upwards, the largest about 2·5 cm. long, 2 cm. wide, ovate, glabrous, coriaceous and ribbed when dry, with scarious edges and a stiff point 1 mm. long. *Spike* squarrose, to about 7 cm. long and 5 cm. wide, the bracts yellow. *Bracts* about 3 cm. long and 1·8 cm. wide, curved outwards, the edges a little incurved near the stiff shortly pointed apex, glabrous, thin and finely ribbed when dried, the edges to a width of about 3 mm. thin and translucent. *Bracteole* broadly tubular, 3-lobed (unequally) about

1·0 cm. long. *Calyx* with ovary 1·5 cm. long, glabrous, deeply 3-lobed; ovary glabrous. *Corolla-tube* a little shorter than calyx, lobes 1·1 cm. long, dorsal 6 mm. wide, laterals 4 mm. *Lip* about 1·3 cm. long, narrowly flabellate, widest (about 1·1 cm.) near the slightly 3-lobed apex. *Staminodes* narrowly triangular, about 3 mm. long. *Filament* 4 mm., anther 6 mm. long, the connective produced to a small crest beyond the pollen-sacs; crest not lobed, broadly rounded, extending hardly 1 mm. beyond the ends of the pollen-sacs and 0·5 mm. on each side of them. *Stigma* rather large, close to the ends of the pollen-sacs. *Stylodes* 2·5 mm. long, fleshy, blunt.

The above description is drawn from a specimen collected at 3,000 feet on G. Padang, Trengganu (S.F.N., 33933, Moysey). The specimen agrees well with Schumann's description of *A. macroglossa* from G. Matang, Sarawak, but is somewhat larger; the only notable differences are that the Trengganu plant certainly has the bracteoles shorter than the calyx (Schumann says bracteole 1·4, calyx 1·3 cm. long), and it has a small anther-crest. The details of the flower are described from dried material soaked in water; they were not seen by Schumann, whose material was evidently in poor condition. I think there can be no doubt of the identity of the Trengganu and Sarawak plants. The extreme length of the ligule and the absolutely glabrous character of all parts of the plant are notable.

Among other Malayan species of Amomum, this is nearest *A. squarrosum* in appearance of the inflorescence and the thin edges of the bracts, and *A. squarrosum* has also stilt-roots. But *A. squarrosum* has the calyx much shorter than the bracteoles, and an anther-crest with wide-spreading narrow lateral lobes (of which there is only a small indication in *A. macroglossa*).

5. **Amomum micranthum** Ridl., J.S.B.R.A.S. 32: 138. 1899. Flora 4: 267.

Rhizome slender, close to surface of ground, leafy shoots 5–8 cm. apart. *Leafy shoots* about 100 cm. tall, slender. *Leaves* dark green, to about 30 by 1·7 cm., apex long-acuminate, base more abruptly narrowed, softly short-hairy or glabrous beneath; petiole none or very short; ligule 2–3 mm. long, usually hairy on the edge, and adjacent edge of sheath hairy also, glabrescent when old. *Peduncle* 4–10 cm. long, slender, densely short-hairy, almost covered by 2-ranked narrow sheaths to 2·5 cm. long. *Inflorescence* elongating to about 5 cm., little over 2 cm. wide when flowering, bearing many flowers. *Bracts* to about 1·5 by 0·4 cm., narrowed to apex, thin, brown, hairy towards the base and at the tip. *Bracteoles* about 4–5 mm. long, 2-lobed, lobes keeled, acute, unequal, tubular and hairy at base. *Calyx* about 1 cm. long, thin, unequally 3-lobed, mouth rather wide. *Corolla-tube* about 1·1 cm. long; dorsal lobe about 7 by 2·5 mm., hooded at apex, nearly erect, lateral lobes against edges of lip, a little narrower, pale yellowish. *Lip* about 8 mm. long (? 1 cm. if fresh), horizontal, oblong with raised sides, the apex crisped, reflexed, shortly cleft, the

whole pale yellowish with a band of pink spots down the centre. *Staminodes:* Ridley says short, linear; apparently absent in some specimens. *Filament* about 3 mm., anther 4 mm. long; connective of anther 3-lobed at apex, lateral lobes narrow, spreading, curved, acute, about 1·5 mm. long, apical lobe reflexed, a little shorter and wider, blunt. *Fruits* similar to those of *A. uliginosum*, almost sessile, ellipsoid, rather more than 1·5 cm. long, dull purple, covered with short fleshy hairs to 2 mm. long.

This species is evidently related to *A. uliginosum* but differs strikingly in the small size of all its parts; the inflorescence also has more flowers and elongates to a proportionately greater length. It is apparently widely distributed in the lowlands of Malaya, but has not often been collected. The dimensions are taken from a dried Penang specimen; colours from Ridley's description. Curtis's note on the type sheet is "centre of lower lobe pink, other parts white." In a pencil drawing he shows a band of small spots down the centre of the lip.

SPECIMENS. *Penang.* Moniot's Road, Curtis 2884 (Type), Ridley 9337. Penara Bukit, S.F.N. 19333 (Holttum). *Perak.* G. Haram, Scortechini 614. *Selangor.* Batu Tiga, Ridley 11924. *Negri Sembilan.* G. Angsi, Ridley 10008.

6. **Amomum macrodous** Scort., Nuov. Giorn. bot. Ital. 18: 309, t. 12. 1886. Ridl., Flora 4: 266. *Hornstedtia macrodus* K. Schum., Pflanzenr. Zingib. 191. 1904.

Leafy stems to about 60 cm. tall. *Leaves* about 5, to 23 by 7 cm., elliptic-acuminate, the base cuneate, glabrous; no petiole; ligule broad, about 3 mm. long, glabrous. *Peduncles* from rhizome near base of leafy stem, to about 5 cm. long, covered with a few sheaths up to 2 cm. long. *Inflorescence* small, elongating to about 3 cm. long, hardly over 2 cm. wide (Scortechini says 4·5 cm.), the base when young enclosed by the two uppermost sheaths of the peduncle which are up to 2 by 1·3 cm. *Bracts* thin, to about 1·5 by 0·5 cm., narrowed to the tip, acute, glabrous. *Bracteole* tubular and hairy at base, c. 5 mm. long. *Calyx* 1 cm. long, (Scortechini has 1·2 cm.). *Corolla-tube* about 5 mm. longer than calyx, lobes 8 mm. long. *Lip* as long as corolla-lobes, apex cleft, yellow, purplish towards base. *Staminodes* tooth-like, very small. *Filament* broad: anther glabrous, connective with a short truncate ciliolate appendage hardly 1·5 mm. long.

This species was described by Scortechini from a specimen gathered in the Kinta Valley (his no. 2027). No later author appears to have seen the specimen or to have added further information about the species. The distinctive features are: small plant with broad sessile leaves, and small inflorescence of small flowers. Two specimens in the Singapore herbarium agree with these characters, but neither has good flowers. A bracteole is present in one of them. The dimensions of parts given above are from these two specimens; where Scortechini's differ notably they are

given in brackets also. The details of the corolla, lip and anther are from Scortechini. The two specimens in the Singapore herbarium are certainly not referable to any other described species of Amomum known to occur in Malaya. They both agree approximately in size of parts with the original description, and were collected in the same part of Malaya. Further collections are needed to fill the gaps in our knowledge.

SPECIMENS. *Perak.* Upper Perak, 300 feet, Wray 3541. Sungei Siput, Curtis s.n. December 1895.

7. **Amomum hastilabium** Ridl., J.S.B.R.A.S. 32: 137. 1899. Flora 4: 266. *A. Holttumii* Ridl., Flora M.P. 4: 264. 1924. ? *A. xanthoglossum* Ridl., Flora M.P. 4: 263. 1924. **Fig. 25, E.**

Rhizome just below ground surface. *Leafy shoots* 2–2·5 m. tall, rather slender, swollen base 2–2·5 cm. wide, sheaths green. *Leaves* to about 50 by 8 cm. (exceptionally to 10 cm. wide), glabrous, when dry very pale grey-green, apex shortly (up to 2 cm.) pointed, base rather narrowly cuneate except in broad lower leaves; petiole 1–2 cm. long, slender; ligule 5–7 mm. long, glabrous, dark green. *Peduncle* 2–10 cm. long, the basal part under ground, the axis hairy, more or less covered with 2-ranked sheaths which are larger towards the apex. *Inflorescence* elongating to about 8 cm., 3–4 cm. diameter, the base covered with the two uppermost sheaths of the peduncle, which are about 3·5 by 1·5 cm. (to 4 by 1·8 cm.), smooth, thin but of firmer texture than the flowering bracts. *Flowering bracts* pale brownish, thin (the lower ones usually grading into the firmer sterile sheaths) elliptic ovate with broad apex (sometimes with a very short tip), about 3–3·5 (–4·5) by 1–1·5 cm., the upper ones smaller, appressed-hairy at the base. *Bracteoles* about 8 mm. long, tubular at the base, slightly hairy near apex. *Flowers* scarcely fragrant. *Calyx* including ovary about 2·2–2·5 cm. long, thin, white, tubular, the apex almost truncate oblique, entire or slightly split on one side. *Corolla-tube* 1 cm.–1·2 cm. longer than calyx, slender, white; lobes pale yellowish; upper lobe standing at about 45° to the lip, a little over 2 cm. long, 1 cm. wide above base, narrowed slightly to hooded shortly pointed apex; lateral lobes touching the sides of the lip, about 6 mm. wide. *Lip* 2·5–3 cm. long, widening gradually from the white base to an almost semi-circular blade with recurved apical part, the edges somewhat crinkled; maximum width when flattened about 2·5 cm.; sides pale yellow, central part near the apex clear orange, continued downwards as a paler orange median band, edged with a pale dull crimson blurred line and short streaks. *Staminodes* narrowly triangular, about 3 mm. long, glandular-hairy, white with pink spots. *Filament* white, about 5 mm. long and 2·5 mm. wide: *anther* about 1 cm. long, pink with minute orange red spots especially along lines of dehiscence, connective produced at the apex into a crest; crest slightly 3-lobed, the lateral lobes erect, not spreading, in planes at right angles to those of the midlobe, about 2·5 mm. long and 1·5 mm. wide, middle lobe with apex slightly reflexed, broadly truncate, about 3 mm. wide and 1·5 mm. high when flattened, all pale pinkish with minute orange-red spots. *Stigma* abruptly widened, pale

pink with minute orange-red spots, style white. *Fruits* sessile, pale buff or slightly pinkish, round with rather prominent longitudinal ridges, covered more or less densely with rather coarse hairs nearly 1 mm. long, about 1·7 cm. diameter, crowned by the persistent calyx. Seeds (slightly unripe) white with fine purple spots, aril translucent.

This species was described by Ridley from the specimens quoted in his original description. His colour notes and some other details are taken from field notes preserved with the Dusun Tua specimen in which the lip is described as 3-lobed. The dried flowers with that specimen have the shape of the lip distorted so that the midlobe appears to be narrow, which is probably the origin of the statement "midlobe narrow oblong." Otherwise the specimens agree closely with that of *A. Holttumii* and with Corner's from G. Panti, in which the apex of the lip is certainly broad and subentire. The colour details given in the above description are taken from Corner's notes and the details of size etc. from alcohol material collected by him. The rather long slender corolla-tube and the very short bracteole are distinctive. In dried specimens the pale grey-green colour of the leaves is also distinctive.

The species is widely distributed in lowland forest in Malaya.

It seems possible that *A. xanthoglossum* Ridl. is this species. The type is at Kew, and there is no specimen at Singapore so named by Ridley.

Specimens. *Kelantan.* Kuala Krai, S.F.N. 10128 (Haniff). *Perak.* Upper Perak, 300 feet, Wray 3476. *Selangor.* Dusun Tua, Ridley s.n. 1896. *Negri Sembilan.* G. Tampin, S.F.N. 9559 (Holttum, type of *A. Holttumii*). *Johore.* G. Panti, Ridley s.n. December 1892. Ulu Segun, G. Panti, 500–1,000 feet, S.F.N. 30744 (Corner). *Singapore.* Seletar, Ridley s.n. November 1889. Bukit Timah, Ridley 9204.

8. **Amomum cylindraceum** Ridl., J.S.B.R.A.S. 32: 136: 1899. Flora 4: 265.

Leaf-shoots to 2 m. or more tall. *Leaves* to 50 by 8 cm., glabrous, drying rather pale grey-green, apex rather shortly acuminate, base gradually narrowed, cuneate; petiole none; ligule large, to 2 cm. long, broad, glabrous (lobed ?). *Scape* apparently above ground, to 17 cm. long, stout, bearing alternate firm persistent sheaths up to 4 cm. long, axis densely short-hairy. *Inflorescence* elongating gradually to 17 cm. long, cylindric, about 4 cm. wide. *Bracts* thin but firm, persistent, smooth, glabrous or appressed-hairy towards the base, broadly ovate, brown, to about 2·7 by 1·8 cm., brittle and splitting when old. *Bracteole* much shorter than calyx. *Calyx* c. 1·5 cm. long, tubular, apex almost truncate, appressed-hairy. *Corolla-tube* about 8 mm. longer than calyx, appressed-hairy outside, lobes orange, about 1·5 cm. long, the dorsal one erect, hooded. *Lip* 3-lobed, deeper orange than corolla, lobes rounded. *Staminodes* small, narrow. *Anther-crest* orange, oblong, with a point at each side. *Fruit* sessile, spherical, nearly 1·5 cm.

diameter, enclosed by persistent bracts, with slight longitudinal ribs, covered with short appressed hairs.

Only known from the type collection from Telok Sera, Dindings (Ridley, March and January 1897).

This species is compared by Ridley to *A. testaceum*, but it is nearer to *A. hastilabium* in its slender corolla-tube and ridged fruits, as also in the shape of the inflorescence. The dimensions given above are taken from the imperfect type specimen, the colours and shape of anther-crest from Ridley.

9. **Amomum rivale** Ridl., Flora Mal. Pen. 5: 338. 1925.

Leaves to 35 by 5 cm. (or possibly larger) with soft spreading hairs 1 mm. long beneath, apex caudate 2·5–3 cm. long, base cuneate; petiole 5–10 mm. long, short-hairy; ligule about 7 mm. long, hairy. *Peduncle* to 7 cm. long, covered with 2-ranked sheaths, the largest 2·5 cm. long, hairy towards the base. *Inflorescence* elongating to 5 cm. or more, with many flowers, diameter when flowering about 2·5 cm. *Floral bracts* to 2·5 cm. long and nearly 1 cm. wide at base, narrowed to apex, thin but firm, appressed-hairy nearly throughout and fringed with spreading hairs. *Bracteole* about 1·3 cm. long, 2-lobed, tubular. *Ovary* densely hairy, short. *Calyx* 1·5 cm. long, unequally and rather deeply 3-lobed, rather densely appressed-hairy throughout. *Corolla-tube* about 2·1 cm. long, hairy outside towards apex, lobes densely appressed-hairy on the backs; dorsal lobe about 1·5 by 0·6 cm., lateral lobes narrower. *Lip* about 1·5 cm. long (or longer?), obovate, concave, slightly 2-lobed at the apex, white with a median yellow band (widening at the apex) and a red line on either side of it. *Filament* short; anther about 7 mm. long; crest of connective apparently 3-lobed, when flattened about 7 mm. across, lateral lobes 2 mm. wide at base, falcate and acute towards apex, middle lobe small.

Type: Pahang, gorge of the Tras, near Raub, 500 feet, S.F.N. 16945a (Burkill and Haniff).

Known only from the type collection, from the lowlands of Pahang. Ridley compares this species with *A. uliginosum*, but *A. rivale* has the corolla-tube conspicuously longer than the calyx, and apparently a much larger anther-crest. The details of the flower are measured from the dried type specimen, and are incomplete. The crest of the anther is not well preserved but I believe it is as above described and not as in Ridley's original description ("3-lobed, central lobe ovate, acute, recurved, lateral ones short oblong erect").

10. **Amomum testaceum** Ridl., J.S.B.R.A.S. 32: 135. 1899. Flora 4: 266. **Fig. 25.**

Leafy shoots 2–3 m. tall, near together from almost superficial rhizome; basal half covered with green sheaths only. *Leaves* to 60 by 10 cm., apex rather gradually narrowed and shortly caudate, base rather narrowly cuneate and sometimes like a winged petiole to 2 cm. long, glabrous except for hairs on edges towards apex; petiole none; ligule 5–15 mm. long, bearing stiff hairs 1·5–3·0 mm. long, or glabrescent; edge of

sheath near the ligule similarly hairy or glabrescent. *Peduncle* of inflorescence usually 6–15 cm. long, exceptionally to 50 cm. *Inflorescence* elongating to 15 cm. or less, oblong, 2·5–3 cm. wide; bracts papery, buff colour, narrowly triangular, with narrow longitudinal grooves (about 1 mm. apart at the base), usually about 3 by 1·2 cm., exceptionally to 4·5 by 1·8 cm., with sparse pale appressed hairs or glabrescent. *Bracteole* 1·5–1·8 cm. long, softly hairy, tubular at the base, 2-lobed, the lobes shortly 2-toothed. *Calyx* covered with shorter pale appressed hairs, 2–2·5 cm. long including ovary. *Corolla-tube* a little longer than calyx, lobes white, about 1·4 cm. long, dorsal one concave, 5 mm. wide when flattened, laterals below lip and appressed to its under surface, about same width as dorsal. *Lip* concave, obovate, about 1·6–2 cm. long and 1·2–1·5 cm. wide when flattened, the broadly rounded apex crinkled and shortly reflexed, a broad dull yellow patch towards the apex joined below to a paler yellow median band which is flanked by purple lines to the base of the lip, where it is hairy. *Stamen* a little over half the length of the lip; filament 3·5 mm. broad, c. 8 mm. long; crest of anther 3-lobed, lateral lobes about 2 mm. long and wide, spreading, middle lobe erect, rounded, 2·5 mm. long; pollen-sacs 4 mm. long. *Stigma* taller than middle lobe of anther-crest, bent back at right angles to the anther. *Staminodes* quite lacking in S.F.N. 31568 (Baling, Corner) and in plant cult. Singapore: Ridley says oblong, truncate (did he see anther lobes?). *Stylodes* blunt, c. 4 mm. long, yellow. *Fruit* globose, slightly pinkish, c. 1·5 cm. long and wide, smooth or slightly ribbed, slightly hairy. *Seeds* brown with a very thin translucent white aril.

Locally common in limestone districts as far south as Batu Caves, but more especially in the north, at Segamat in Johore (by roadside, planted?) and on Pulau Tioman. A plant in the Botanic Gardens, Singapore, flowered in May 1944. The plant at Segamat had many inflorescences in April 1947 when the Gardens plant had none. *Distribution:* Borneo.

11. **Amomum squarrosum** Ridl., J.S.B.R.A.S. 57: 104. 1910. Flora 4: 265.

Rhizome supported on stout stilt-roots to 15 cm. long. *Leafy stems* close together, to 3 or 4 m. long, the basal 2/5 leafless, the sheaths yellowish, reddish at extreme base of stem (Corner). *Leaves* to 55 by 6 cm., upper ones much narrower, lower surface short-hairy all over, apex acuminate, base narrowly cuneate; petiole 0–2 cm., slender, short-hairy beneath or glabrescent; ligule entire, usually short-hairy, to about 1 cm. long. *Peduncle* 10–15 cm. long, sheaths about 3·5 cm. long and 3 cm. apart, broad, firm, apex rounded with a short subapical point. *Inflorescence* elongating to about 10 cm., the base enclosed by two large sheaths like those of the peduncle, about 3·5 cm. diameter at flowering. *Bracts* persistent, firm but thin, green with broad membranous edges, to c. 2 by 1·3 cm., apex acute, sometimes reflexed, fringed with hairs towards the base. *Bracteoles* funnel-shaped, nearly 2 cm. long, 3-lobed, short-appressed-hairy all over. *Calyx* with ovary c. 1·4 cm. long, funnel-shaped, thin, glabrous, with 3 rather large unequal lobes, pale pink. *Corolla-tube* shorter than calyx; dorsal lobe c. 1·5 cm. long and 1·2 cm. wide,

concave, apex slightly 3-lobed, white tipped with pink; lateral lobes c. 7 mm. wide, white. *Labellum* white with a broad median longitudinal yellow band edged with red and with short red lines spreading laterally, distinctly 3-lobed, nearly 2 cm. wide, the lateral lobes broadly rounded and spreading, erect towards the base, midlobe entire, round, about 7 mm. wide and 5 mm. long. *Staminodes* as small triangular lobes at base of lip, basal edge 3 mm., distal edge 2 mm. *Filament* short and broad. *Anther* about 8 mm. long, the connective at the apex 3-lobed, lateral lobes spreading, about 1 mm. wide, distance from tip to tip (i.e. total width of crest) c. 8 mm., middle lobe short, rounded, about 2 mm. wide and 1 mm. long; the whole anther creamy-white. *Stigma* cup-shaped, the aperture a narrow transverse ellipse, glabrous. *Fruits* enclosed by the more or less persistent bracts, round, smooth, or with slight longitudinal ridges towards the apex, about 1·3 cm. diameter, thin-walled, crowned with the persistent calyx.

This small-flowered species has been found in the lowlands of Perak, Trengganu and Malacca. There is no record of the use of the fruits as a spice, or of cultivation. The stilt-roots are reported by Corner only, and the floral details are described from his Trengganu specimen, with his colour notes.

SPECIMENS. *Malacca.* Alvins 3318. *Perak.* Ulu Temango, Ridley s.n. July 1909. Tapah, Ridley 14026, Wray 1412. *Selangor.* Pahang Track, 15 mile, Ridley s.n. 1897. *Trengganu.* Bukit Kajang, Kemaman, 600 feet, S.N. 30235 (Corner).

12. **Amomum citrinum** (Ridl.) Holtt., **comb. nov.** *Conamomum citrinum* Ridl., J.S.B.R.A.S. 32: 121. 1899. Flora 4: 255. *Amomum cylindrostachys* Ridl., J.S.B. R.A.S. 61: 42. 1912. Flora 4: 265.

Closely related to *A. squarrosum* Ridl., differing as follows: *Leaves* rather broader (to 8 cm. wide), glabrous beneath; *petioles* not more than 5 mm. long. *Peduncle* 25–40 cm. long; sheaths shorter than internodes. *Bracts* firmer, a little broader, not reflexed, entirely green, glabrous. *Anther-crest* spotted with red, the lateral lobes red. *Labellum* with cream side-lobes.

This might perhaps be regarded as a mountain variety of *A. squarrosum;* we still lack full details of the size of the parts of the flower, which may show further differences. I have not seen the staminodes of *A. citrinum.* Ridley says they are dull red. This species has been found at a number of localities on the Main Range and Taiping Hills, whereas *A. squarrosum* is a lowland species.

SPECIMENS. *Perak.* Maxwell's Hill, Ridley 2959. Bujong Malacca, Ridley 9788. Waterfall, Taiping, Ridley 14447. *Selangor.* Sempang Track, Ridley 15614. Fraser's Hill, Path to Jeriau, 3,500 feet, S.F.N. 21572 (Holttum).

13. **Amomum utriculosum** (Ridl.) Holtt., **comb. nov.** *Conamomum utriculosum* Ridl., J.S.B.R.A.S. 32: 122. 1899. Flora 4: 255.

Rhizome supported on stilt-roots, stout. *Leafy shoots* 2–2·5 m. tall. *Leaves* to 70 by 13 cm., glabrous, apex shortly acuminate, base narrowly cuneate; petiole 1–2 cm. long, glabrous; ligule glabrous, to 2·2 cm. long. *Peduncle* 12–20 cm. long, glabrous, covered by overlapping broad blunt sheaths, the largest c. 4·5 cm. long. *Rachis* of inflorescence elongating up to 40 cm. (more commonly to 20 cm.), stout, glabrous. *Bracts* 3–4·2 cm. long 1·5 cm. wide, acute, thin, firm, glabrous, with narrow prominent veins; base of bract joined to pedicel of flower for c. 4–5 mm. *Bracteoles* inflated, to nearly 3 cm. long, apex unequally 3-lobed, not deeply split, glabrous. *Calyx* shorter than bracteole, with ovary to 2 cm. long, glabrous, wide, the apex broadly lobed. *Corolla-tube* hardly as long as calyx; lobes 1·7 cm. long, dorsal 1 cm., laterals 6 mm. wide. *Lip* yellow with red veins, broadly 3-lobed from a narrow base, lateral lobes broad, round, middle lobe smaller, round, slightly reflexed, total length c. 2–2·5 cm. *Staminodes* not seen (Ridley says linear). *Filament* red, 6 mm. long; anther 6 mm. long; crest red, midlobe small, rounded, lateral lobes narrow, curved, acute, 4–5 mm. long. *Fruit* rather narrowly ellipsoid, smooth, 3 cm. long.

This species is closely allied to *A. citrinum* and *A. squarrosum*, having the calyx shorter than the bracteole and the anther-crest with narrow spreading curved lateral lobes. It is however a much larger species than the other two, having more the aspect of *A. spiceum;* but the bracteole is not split. Probably *A. spiceum* and *A. xanthophebium* are allied to this group. *A. utriculosum* is a mountain plant, found at many localities, and seems to be common on the Taiping Hills.

Specimens. *Perak.* Maxwell's Hill, Ridley 5190 (Syntype) and s.n. March 1892. Tea Gardens, Curtis 2714 (Syntype). G. Batu Puteh, Wray 1013 (Syntype). Maxwell's Hill, 4,000 feet, S.F.N. 12955 (Burkill and Haniff). G. Kerbau, 4,000 feet, Robinson s.n. 1913. Without locality, Anderson 139 (p.p.). G. Hijau, Anderson 40. *Pahang.* Telom, Ridley 13834. G. Tahan 3,300 feet, Wray and Robinson 5424.

14. **Amomum ochreum** Ridl., J.S.B.R.A.S. 32: 135. 1899. Flora 4: 264.

Rhizome underground; intervals between leaf-shoots 5–12 cm. *Leaf-shoots* 2 to nearly 5 m. tall, basal 2/5 covered with sheaths only, base nearly white. *Leaves* commonly to about 40 by 8 cm. (sometimes to 52 by 10 cm.), apex caudate (cauda to 5 cm. or more long) base rather abruptly rounded and slightly unequal, under surface usually glabrous but sometimes softly hairy (hairs not on sheath or ligule); petiole 1–3 cm. long (usually at least 2 cm.); ligule glabrous, broad, unlobed, to about 7 mm. long. [The leaf of the type sheet of this species is much larger, of different texture, with very short broad petiole and large hairy ligule—it must belong to another species]. *Peduncle* 8–20 cm. long, slender at flowering, thickening at fruiting, when young covered with broadly ovate

thin alternate sheaths 2–3 cm. long which do not clasp the axis. *Inflorescence* lengthening to about 10 cm., about 5 cm. diameter at flowering. *Bracts* thin, pale brownish, soon disintegrating, ovate, usually about 4 by 1·5 cm. (to 2 cm.), narrowed to the tip, glabrous. *Flower* hardly pedicelled. *Bracteole* 2·2–2·5 cm. long, tubular at base, 2-lobed, glabrous. *Calyx* c. 3·2 cm. long including ovary, thin, broadly 3-lobed, nearly glabrous, translucent, brownish. *Corolla-tube* about as long as calyx, dorsal lobe 2·5 cm. long and nearly 2 cm. wide, nearly circular, lateral lobes 1 cm. wide; dorsal lobe purple-red outside, paler with red veins inside, laterals pale yellow with red veins. *Lip* obovate, concave, c. 3 cm. long and wide, slightly 3-lobed, lobes broadly rounded, dull pale orange-yellow richly veined with red and speckled with red round the edge. *Staminodes* narrow, 8–9 mm. long, white with red markings. *Filament* pale yellow with red spots, 7–9 mm. long; anther pale yellow c. 1 cm. long; anther-crest transversely oblong, c. 1 cm. broad and 3 mm. deep, or the two halves somewhat triangular, apex slightly retuse, faintly red-spotted. *Style* white, *stigma* yellowish. *Fruits* green (when ripe?) almost spherical, to 4·5 cm. diameter, surface smooth with short blunt fleshy spines under 2 mm. long: wall of fruit 8 mm. thick, fleshy, pedicel 7 mm. long: seeds irregular, to 1 cm. long, covered with thin aril.

This has the largest fruits of any Malayan species, but they are said to have little flavour and are not recorded as used for cardamoms. The very short irregular scattered spines are peculiar. The species is found at medium elevations on the hills in many parts of Malaya.

SPECIMENS. *Kedah.* B. Kuala Bintang, near G. Bintang, S.F.N. 21072 (Haniff). *Selangor.* Ginting Bidai, Ridley s.n. May 1896 (Type). Kepong, Forest Dept. 24458 (Symington). *Negri Sembilan.* G. Angsi, Lewton-Brain s.n. 1913. G. Tampin 2,300 feet, S.F.N. 3177 (Burkill), 9558 (Holttum). *Pahang.* Fraser's Hill, S.F.N. 33244 (Corner). Boh Plantation, Cameron Highlands, 3,700 feet, S.F.N. 32685 (Md. Nur).

15. **Amomum cephalotes** Ridl., Flora Mal. Pen. 4: 264. 1924.

Rhizome subterranean. *Leaf-shoots* apparently about 2 m. tall, rather slender; leaves about 3 cm. apart. *Leaf-blade* to about 42 by 3 cm. (or ? to 50 by 6 cm.), glabrous, apex somewhat acuminate-caudate, cauda to 4 cm. long, base rather abruptly narrowed, midrib pale, broad, very shallowly channelled above; petiole not over 2–3 mm. long; ligule nearly 1 cm. long, thin, usually glabrous. *Peduncle* from slender underground branch of rhizome, to about 10 cm. long, the sheaths soon decaying, axis short-hairy. *Inflorescence* at surface of ground, globose, hardly elongating, about 5 cm. tall and wide when flowering. *Floral bracts* thin but rather persistent, the outer ones to about 3 by 1·2 cm., oblong with inflexed rounded apex, densely appressed-hairy towards apex. *Bracteole* c. 1·5 cm. long, tubular, the apex slightly 2-lobed, short-hairy. *Calyx* c. 2·8 cm. long (including ovary and short pedicel), tubular, 2-lobed at apex, split only 5 mm. between the lobes, an upcurved short-hairy point 2 mm. long just below the rounded apex of each lobe. *Corolla-tube* as long as calyx. Dorsal lobe

2 cm. long, with concave hooded apex 1 cm. wide when flattened, lateral lobes, on either side beneath the lip, 6 mm. wide, all lobes pink. *Lip* slightly 3-lobed, c. 2·5 cm. wide when flattened and little over 2 cm. long, side-lobes broadly rounded, white, midlobe about 8 mm. wide, nearly semicircular; a yellow median band edged with red extending from midlobe back into throat of lip, midrib of lip thickened, with a narrower thickened rib close to each side of it towards the base. *Staminodes.* Base of lip each side with 2 separate triangular lobes of almost equal size, about 3 mm. long and less than 2 mm. wide at the base. *Filament* 8 mm. long and 2 mm. wide. *Anther* 7 mm. long, the connective produced at the tip into a simple concave oblong slightly retuse crest little wider than the anther (c. 4 mm. wide), overarching the stigma. *Stigma* small, abruptly widened, cup-shaped. *Fruits* in a close head, on pedicels to 2 cm. long (?), similar to those of *A. aculeatum* and *A. lappaceum.*

This species has only been found in Pahang and on P. Tinggi, in densely shaded damp places. It is nearly allied to *A. aculeatum* but differs in the more persistent bracts, the teeth of the calyx, the absence of red spots and lines in the yellow part of the lip and the much smaller crest of the anther. The P. Tinggi specimen lacks flowers; it has leaves to 50 by 6 cm., which are much wider than those of the Pahang specimens, but the latter may not include leaves of maximum size.

SPECIMENS. *Pahang.* Gunong Senyum, Evans 13117 (Herb. F.M.S. Mus., type). Tembeling, S.F.N. 24520 (Henderson). *Johore.* Pulau Tinggi, S.F.N. 882 (Burkill).

16. **Amomum lappaceum** Ridl., J.S.B.R.A.S. 32: 134. 1899. Flora 4: 263. *A. perakense* Ridl., J.S.B.R.A.S. 32: 135. 1899. Flora 4: 266.

Rhizome at or near surface of ground, often supported on short stout stilt-roots. *Leaf-shoots* to about 3 m. tall. *Leaves* to about 53 by 9 cm. (rarely wider), apex shortly acuminate, base cuneate, quite glabrous, midrib prominent and rather pale beneath when dry, narrow and rather deeply grooved above; petiole none or to 5 mm. long; ligule very short (rarely over 3 mm. long), broad, somewhat retuse, usually glabrous but sometimes with short hairs. *Peduncle* from rhizome near base of a leaf-shoot, usually about 5 cm. long at flowering, elongating somewhat later, covered when young with close thin overlapping sheaths which quickly decay except for their bases. *Inflorescence* gradually elongating, continuing to flower at the apex while the fruits ripen at the base, the final length sometimes 35 cm. *Bracts* very thin, soon decaying and exposing the developing fruits, pale green, somewhat hairy when young, to about 3 cm. long and nearly 1 cm. wide. *Bracteole* tubular and hairy at the base, c. 1·5 cm. long, 2-keeled and 2-lobed, split deeply down one side. *Pedicel* 2·5 mm. long, ovary 3·5 mm., both densely hairy; *calyx* nearly 2 cm. long, 2 or 3-lobed. *Corolla-lobes* c. 1·6–2·0 cm. long, the dorsal lobe c. 1·5 cm. wide, laterals much narrower, all thin translucent, with longitudinal pinkish lines more or less distinct. *Lip* a little wider than the dorsal sepal,

concave, ovate, slightly 3-lobed (size of midlobe varies), clear yellow, edges crisped and apex ± retuse. *Filament* 4–8 mm. long, anther about 8–11 mm., the connective produced at the apex to a semicircular crest not or hardly wider than the anther. *Staminodes* narrowly triangular, about as long as the filament, yellow with red base (sometimes almost entirely joined to the base of the lip). *Stigma* abruptly widened, opening narrow with hairy edges, otherwise glabrous. *Fruits* ellipsoid, green (when ripe ?) to about 3·5 cm. long and 2·5 cm. wide (including spines), covered with large fleshy spines which are irregularly joined laterally at their bases, *not* in longitudinal lines; pedicels stout, appressed-hairy, 1·5–2 cm. long.

The original *A. lappaceum* had a rather much elongated inflorescence (22 cm. long without peduncle and still flowering at the apex), was said to have no staminodes, and no report of stilt-roots supporting the rhizome. *A. perakense* was described from a flowering specimen, its inflorescences lacking fruits, the lower flowerless part not much elongated, bearing the pedicels of fallen flowers close together. Fruiting specimens corresponding to this have been collected at Cameron Highlands, the fruiting head rather compact and only 12 cm. (excluding peduncle). The fruits appear to be just like those of *A. lappaceum*. The flowers of *A. perakense* had short staminodes.

Ridley records that the fruits are eaten by Sakai. The species is closely related to *A. aculeatum* Roxb. (the seeds of which are also eaten) but has smaller flowers with a narrow anther-crest, and the axis of the inflorescence elongates very much more than in *A. aculeatum*. The name *lappaceum* (bur-like) is appropriate. The fruits have very much the size and appearance of Rambutans (*Nephelium lappaceum*).

SPECIMENS. *Perak.* Maxwell's Hill 4,000 feet, S.F.N. 13214 (Burkill and Haniff), Ridley s.n. June 1893 (type of *A. perakense*). Taiping Hills, 2,500 feet, Ridley s.n. December 1902. No locality, Wray, Scortechini 222b. Six miles from Tapah towards Jor, S.F.N. 13429 (Burkill and Haniff). *Selangor.* Semangkok Pass, Ridley s.n. 1904. Ulu Gombak, 1,500 feet, Hume 8562 (Herb. F.M.S. Mus.). Ginting Peras, Ridley 7802 (type of *A. lappaceum*). *Pahang.* Cameron Highlands: Brinchang, 5,000 feet, S.F.N. 31291 (Holttum); Boh Plantations, 4,000 feet, S.F.N. 32927, 32634 (Md. Nur). Telom, Ridley 13851.

In August 1946 I found two slightly different forms of this species at Cameron Highlands, one fruiting, the other not. The only clear difference between them was in the lip and staminodes. In a plant in a shady place at Tanah Rata, the lip had a midlobe 9 mm. wide and 7 mm. long, and the staminodes were narrowly triangular, 5 mm. long, separate from the base of the lip; the filament was 8 mm. long. In a plant in a clearing at Brinchang, the lip

had a midlobe only 4 mm. wide and 3 mm. long, the staminodes were almost entirely adnate to the lip, and the filament was 6 mm. long. In a former collection from Brinchang, the midlobe of the lips was about 6 mm. wide and 5 mm. long. I conclude therefore that the shape of the lip varies somewhat and also the condition of the staminodes, and possibly exposure may have some effect on the shape of the lip. The 1946 Brinchang plants had not a much elongate fruiting axis. This again may have been due to conditions of exposure.

17. **Amomum aculeatum** Roxb., Asiat. Res. II: 344, t. 6. 1810. Fl. Ind. Ed. 1, 1: 40. 1820. Valet., Ic. Bog. 2: t. 154, 157. 1905. Valet., Bull. Inst. Bot. Buit. 19: 20, 25. *A. flavum* Ridl., J.S.B.R.A.S. 32: 133. 1909. Flora 4: 263. ? *A. aurantiacum* Ridl., Flora 4: 262. 1924.

Rhizome underground. *Leafy shoots* to 4 m. high (usually not much over 2 m.); leaves rather close, usually about 4–5 cm. apart. *Leaf-blade* to about 40 by 6 cm., apex acuminate-caudate (cauda to 2·5 cm. long), base cuneate, lower surface, especially midrib, very short-hairy beneath or more or less glabrescent, midrib on upper surface broad and shallowly grooved in dried specimens; petiole to about 5 mm. long; ligule broad, to about 1 cm. long (usually about 7 mm.), short-hairy all over or glabrescent; sheaths very short-hairy or glabrescent. *Peduncle* subterranean, short. *Inflorescence* with base in the ground, short, dense, rounded, c. 4 cm. high and wide, excluding the flowers. *Bracts* thin, appressed-hairy, c. 3·5 by 1·5 cm., soon disintegrating, brownish. *Flowers* erect. *Bracteoles* 1·8 cm. long, tubular at the base, short-hairy. *Calyx* to 3 cm. long, including ovary and short pedicel, 2-lobed, appressed-hairy. *Corolla-tube* hardly as long as calyx; lobes transparent, orange, the dorsal one to 2·5 by 1·5 cm., forming a closed cup with the lip, the laterals narrower, close against the sides of the lip. *Lip* 2·5–3 cm. wide, little longer than the corolla-lobes, slightly 3-lobed, the lateral lobes broadly rounded, erect, the middle lobe slightly reflexed, edges more or less crisped; colour of lip orange-yellow, with many small crimson spots and lines. *Filament* about 1 cm. long; *anther* nearly 1 cm. long, orange, the connective produced at the apex into a spreading oblong-crescent-shaped crest, the upper margin slightly lobed, c. 1 cm. wide and 4 mm. deep, veined with orange. *Staminodes* very small (or absent ?). *Stigma* cup-shaped, hairy. *Fruits* in a dense short head on the thickened axis of the inflorescence; pedicels short-hairy, c. 1·5 cm. long, fruit c. 3·5 by 2 cm., covered with fleshy spines c. 5 mm. long which are irregularly united transversely at their bases, greenish.

This species was described by Roxburgh from plants cultivated at Calcutta and imported from an unknown locality in the East Indies. It occurs wild and cultivated in Java; Ridley reports it (as *A. flavum*) also from Sumatra. In Malaya it has only been collected in Penang. Valeton (Ic. Bog. 2: 203) reports that the bracts decay to a mucilaginous mass in which the fruits develop. This is

not mentioned by Ridley. A drawing made at Penang shows the inflorescence half buried in the earth, and this is also reported by Valeton. Curtis gave the leaf-shoots as 12–15 feet high, but this appears to be exceptional and is perhaps an exaggeration. Penang plants have all distinctly hairy (very short-hairy) leaves. In Java the leaves are reported as glabrous, but a specimen from Buitenzorg has hairy ligules.

The fruits are very similar to those of *A. lappaceum* but that species has a much longer inflorescence and smaller flowers with small anther-crest. As with *A. lappaceum*, the fruits of *A. aculeatum* are edible.

SPECIMENS. *Penang.* Waterfall Gardens: Curtis 2275 (type of *A. flavum*); S.F.N. 7621 (Burkill). Pulau Boetong, Curtis 2275. Balik Pulau, Ridley s.n. July 1898 (fruit). Penara Bukit, Curtis 7226.

18. **Amomum uliginosum** Koenig, Retz. Obs. Bot. 3: 56. 1783. Ridl., J.S.B.R.A.S. 32: 136. 1899. Flora 4: 264. **Fig. 26.**

Rhizome subterranean, with long intervals between leaf-shoots. *Leafy shoots* 2–3 (? to 4) m. tall, sheaths green, more or less covered with a short woolly brownish tomentum, the upper ones often glabrescent. *Leaf-blades* green, to 50 by 7 cm., apex abruptly caudate, the narrow part decurved, to 5 cm. or more long, base cuneate, without petiole; ligule slightly emarginate, (apex broad) to c. 7 mm. long, glabrous or more or less hairy like the leaf-sheaths. *Peduncle* from rhizome, to about 10 cm. long, slender, more or less covered with ovate alternate pinkish sheaths. *Inflorescence* small, globose, when flowering c. 3 to 5 cm. long and 3 cm. wide, about 15 flowers. *Bracts* thin, smooth (veins hardly raised), at first pale pinkish, then brownish, elliptic-oblong, 2·5–3 cm. long, to 1·2 cm. wide, appressed-hairy towards the base, persisting almost to fruiting. *Bracteole* 2·2 cm. long, tubular at base, 2-lobed, split nearly half-way to base on one side, hairy towards base. *Calyx* 2·5 cm. long (including ovary), 3-lobed, a keel ending in a tooth just below apex of each lobe, appressed-hairy towards base, white with pinkish keels. *Corolla-tube* 2·1 cm. long, 2·5 mm. wide at base, 5 mm. wide near apex when flattened, dorsal lobe 1·5 cm. long, hooded, retuse lateral lobes close to the side of the lip, about 1·5 cm. long and 5 mm. wide, lobes translucent white, pinkish towards apex and base. *Lip* spreading at a wide angle to upper petal, ovate above the rather narrow fleshy base, c. 2·5 cm. long and 1·5 cm. wide, strongly concave; base white, with or without two dark red spots, blade white with a median yellow band having a dark crimson stripe on each side of it and a few short oblique crimson stripes outside the long stripes at the base. *Staminodes* at base of lip, c. 4 mm. long, 1·5–2 mm. wide, blunt, white; sometimes absent. *Filament* 7 mm. long and nearly 2 mm. wide, white, pinkish at the base. *Anther* 6 mm. long, 4 mm. wide below the crest, pale cream; crest of connective 3-lobed, white, the side-lobes spreading, c. 2 mm. long and nearly as wide, the middle lobe reflexed on to back of anther, 2·5 mm. long and 4 mm. wide,

the end truncate, slightly 2-lobed, the lobes with wavy edges. *Stylodes* two, 3 mm. long, flat, apices broad, blunt, quite separate on either side of excentric base of style. *Fruits* to about 2 cm. long and 1·4 cm. diameter (including spines), obovoid, covered with slender soft red spines to 2·5 mm. long.

This is a common species in Malaya, locally abundant, found from Kedah southwards to Johore in the lowlands. The type of the species was collected by Koenig in the island of Junk Ceylon. He describes a small plant, and does not mention the caudate apices of the leaves, which are usually conspicuous, but otherwise his description agrees well with plants collected in Malaya.

There is much variation in size of plants and of leaves. Small plants often have leaves not over 5 cm. wide, and the uppermost leaves only 2 cm. wide. The width of one inch given by Ridley is exceeded in the majority of plants. The sessile caudate leaves, the small inflorescences, with lip and upper petal at a wide angle apart, the concave lip with red-bordered median band, the shape of the anther-crest and the red-spiny small fruits are characteristic. Ridley records that the plant was planted by Jakuns in Malacca for its fruits.

A. gracile Bl., as figured by Valeton in Ic. Bog. 2, t. 158, is nearly related to *A. uliginosum,* but is evidently a much smaller species with very few flowers on each inflorescence, and shorter thinner spines on the fruit.

Specimens. *Kedah.* Yan woods, Ridley s.n. 1893. *Kelantan.* Gua Musang-K.Betis track, S.F.N. 29654 (Henderson). *Penang.* Balik Pulau, Ridley 9414. *Perak.* Bujong Malacca, Curtis 3780 (cult. Penang). Ulu Temango, Ridley 14421. Larut, King's Collector 1839. Kulim Valley, S.F.N. 13808 (Burkill and Haniff). Grik, S.F.N. 13829 (Burkill and Haniff), 31648 (Corner). *Selangor.* Dusun Tua, Ridley s.n. May 1896. *Malacca.* Foot of Bukit Tampin, Goodenough 1934. Bukit Sedanan, Derry 238, Goodenough 1435. *Pahang.* Kuantan, Bukit Galang, Burn-Murdoch s.n. 19.6.1913. Pengkalang Kasai, Ridley s.n. 1891. K. Tembeling, Ridley 2404. Kota Glanggi, Ridley s.n. 1891. *Johore.* Sungei Pauh, Idris 11345. Ulu Madik, S.F.N. 10641 (Holttum). S. Sebang, Jason Bay, Corner s.n. 15.6.1934. Sungei Pelepah, near G. Panti, S.F.N. 20041 (Md. Nur). Ulu Kahang, S.F.N. 10922 (Holttum).

10. ELETTARIOPSIS Baker

Rhizome slender, wide-creeping, bearing leaf-shoots at intervals of 10–25 cm. *Leaf-shoots* with pseudo-stem (of folded sheaths) up to about 60 cm. long, 1–5 of the leaves having blades; blades sometimes fairly large, caudate or not; petioles of the inner leaves rather long and relatively slender, *erect* (to 20 cm.); ligule small or large. *Inflorescence* arising at base of a leaf-shoot, the scape prostrate, at

or just below ground level, simple or branched, up to about 20 cm. long, bearing 2-ranked scale-leaves; flowers well-spaced along the prostrate branches of the inflorescence or in a close erect head of up to 10 bracts at their apices; floral bracts not tubular, more or less ovate; flowers singly or in pairs in the axils of the bracts, with an evident pedicel or not, each bract with a single open (not tubular) relatively broad bracteole. *Structure of flowers* as in Amomum, the lip erect, broad, white with a yellow median band and red stripes; *filament* short and broad, *anther* rather short with a petaloid crest as long as the pollen-sacs or longer, somewhat concave and slightly reflexed, more or less quadrate, 3-lobed or slightly toothed, without any spreading lateral lobes: *stigma* cup-shaped, much smaller than the crest, the aperture a broad or narrow triangle or ellipse fringed with hairs: *staminodes* absent or very short and fleshy in known species; *stylodes* slender; *fruits* unknown. *Type species: E. Curtisii* Bak., F.B.I. 6, p. 252 (syn. *E. serpentina* Bak).

This genus is closely related to Amomum. It differs in having short leafy stems with few almost erect leaves having rather long slender petioles, and in the prostrate inflorescences with open, not tubular, bracteoles. The species *E. Curtisii* differs strikingly from Amomum in having solitary well-spaced flowers on a horizontal axis, the bracts being apparently 2-ranked; but *E. triloba* has small compact erect heads of flowers, with spirally arranged bracts as in Amomum, the bracteoles open as in *E. Curtisii*. *E. triloba* is thus intermediate in habit between Amomum and *E. Curtisii;* but it is peculiar in having 2 flowers to each of its middle bracts, the bracteoles arranged as in *Hornstedtia leonurus* but split to the base. There may rarely be even 3 flowers to one bract.

As the flowers are produced just below the surface of the ground, often in a layer of decaying leaves, they need to have a rather long floral tube to bring their corolla-lobes, lip etc. well into the air. The actual length of calyx and corolla-tube seems to be very variable within a single species, and is very likely due to the thickness of the layer of debris through which a flower has to penetrate. The relation of length between corolla and calyx tubes is however fairly constant within a species. Few species of Amomum have such long corolla-tubes as those of Elettariopsis.

The anther-crest is distinctive, being thin in texture and much elongate (about as long as the pollen-sacs) but not widely spreading as usual in Amomum. It lacks

entirely the often widely spreading lateral lobes common in the anther-crest of Amomum.

Ridley included in this genus *Amomum biflorum* Jack (which he re-named *Elettariopsis pubescens*) ; but *A. biflorum* has the inflorescences rising vertically from the rhizome with the structure of typical Amomum, a 3-lobed anther-crest, and also short petioles to the leaves. The chief difference between *A. biflorum* and *A. kapulaga* (*A. cardamomum* sensu Valet.) is the very small number of flowers on the inflorescence. The only resemblance to Elettariopsis is in the very long corolla-tube.

Ridley also included his *E. longituba* and *E. multiflora* in this genus; but they differ both from Elettariopsis and from Amomum in the peculiar structure of their inflorescences, which agree exactly with that of *Elettaria cardamomum*. They are therefore referred to Elettaria, and are further discussed under that genus.

The species *Elettariopsis exserta* (Scort.) Bak. is a dubious one as it has never been fully described, but it is probably related to *E. Curtisii*.

Owing to imperfect descriptions, it is impossible to say which non-Malayan species so named by Loesener are referable to Elettariopsis in the present restricted sense. Some of them are certainly Elettaria. It may also prove that some species referred to Amomum should be included in the present genus. Even as far as Malayan species are concerned, a good deal of further information is desirable to establish their status, and that of the genus also.

The leaves of *E. Curtisii* and *E. triloba*, when crushed, have a rather unpleasant pungent odour, somewhat similar to that emitted by various kinds of bugs; that of *E. Curtisii* is the stronger odour.

KEY TO MALAYAN SPECIES OF ELETTARIOPSIS

One leaf-blade only to each leaf-shoot, blade to 100 cm. long
1. *E. exserta*.

Usually more than one leaf-blade to each leaf-shoot; blades much smaller

Pseudo-stem of leaf-shoot 10–30 cm. long; flowers singly, spaced up to 2 cm. apart; corolla-tube up to 3·5 cm. longer than calyx 2. *E. Curtisii*.

Pseudo-stem of leaf-shoot 25 to 60 cm. long; flowers in compact heads of 6–10 bracts at apex of inflorescence and of its branches (if any) ; corolla-tube not more than 1 cm. longer than calyx 3. *E. triloba*.

1. **Elettariopsis exserta** (Scort.) Bak., F.B.I. 6: 251. 1892. Ridl., Flora 4: 274. *Cyphostigma exsertum* Scort., Nuov. Giorn. bot. Ital. 18: 310, t. 13. 1886.

Rhizome slender. *Leafy shoots* with one leaf-blade only. *Leaf-blade* to 1 m. long and 25 cm. (?) wide, petiole long (including sheath ?). *Flowers* solitary, terminating an erect peduncle 1·2 cm. long: scale-leaves on peduncle 1·2 cm. long. *Calyx* 2·3 cm. long, slender, tubular. *Corolla-tube* slender 7 cm. long, lobes 1·8 cm. long. *Lip* oblong, entire, 2·3 cm. long, yellow with 2 red lines. *Anther-crest* rounded.

This species was described by Scortechini from a specimen collected by him in the Kinta Valley (no. 1947). The details of the above description are taken from Schumann (Pflanzenreich); the width of the leaf is there stated to be 2·5 cm. which is obviously an error. Ridley gives 12 inches in his 1899 paper and 6 inches in his Flora for the width of the leaf. There is a Sumatran specimen collected by Forbes which has a single large leaf 90 by 14 cm., with petiole and sheath together about 70 cm.; it has no flowers but might be this species. I have neither seen the original description and figure nor any authentic specimen. The species is probably a true Elettariopsis allied to *E. Curtisii*, but with so large a leaf is surely different. Ridley refers here a specimen from Tapah with a leaf 54 by 10 cm., which might be a large *E. Curtisii:* the specimen has a detached flower but no inflorescence.

2. **Elettariopsis Curtisii** Bak., F.B.I. 6: 252. 1892. Ridl., Flora 4: 274. *E. serpentina* Bak., l.c. *E. latiflora* Ridl., J.S.B.R.A.S. 32: 154. 1899. Flora 4: 274. **Fig. 27, 28.**

Rhizome slender, bearing leaf-shoots at intervals of 10–25 cm. *Leaf-shoots* with 1–5 leaves, the longest sheath 10–30 cm. long. *Leaf-blade* 25 by 3·5 to 40 by 10 cm., widest at or above the middle, apex acuminate, not or only slightly caudate, base narrowed gradually, glabrous or very short-hairy beneath; petiole of inner leaves 5–20 cm. long; ligule to 2 cm. long (see *E. triloba*). *Inflorescence* from base of leaf-shoot, horizontal, just below surface of ground, to about 20 cm. long, sometimes with lateral branches near the base; lateral branches short, developing later than the apical part of the inflorescence, breaking through the bases of the sheaths in the axils of which they arise; basal sheaths 2-ranked, about 2 cm. long, appressed to axis; floral bracts on distal part of inflorescence spirally arranged, spreading; axis and bracts pinkish. *Bracts* c. 1·2–1·5 cm. long, ovate, acute or broadly pointed; flower on a pedicel 0·1 to 2 cm. long in axil of bract. *Bracteole* c. 1·3–1·5 cm. long, split to the base on one side, apex broadly rounded and slightly toothed or 2-lobed, attached at base of ovary, *at top of pedicel*. *Calyx* c. 3·5 cm. long, with 3 short blunt teeth close together or 2 together and one separated, cleft 1 cm. down one side, white. *Corolla-tube* 1·5–3·5 cm. longer than calyx, slender; lobes 1·7 cm. long, upper strongly concave at the tip, c. 6·5–7·5 mm. wide, laterals 5–6·5 mm. wide; all

lobes transparent, cream or whitish. *Lip* c. 2·8 cm. long and 2·5 cm. wide, blade almost round, widening abruptly from a narrow base 8–9 mm. long; apex reflexed and crinkled at edges; median band thickened: sides white to pale yellow, median band deep yellow to orange with a crimson line on either side towards base. *Filament* c. 4 mm. long and wide; pollen-sacs 4 mm. long, diverging towards the apex; crest thin, obliquely reflexed, about 4·5 mm. long, 3-lobed, the lateral lobes half or more of the total length, facing each other, rounded, the apical lobe rounded and slightly retuse (sometimes crest to 7 mm. long ?). *Stigma* much smaller than the crest, nearly spherical, diameter about 2 mm., the aperture apical, a broad ellipse fringed with hairs. *Staminodes* small fleshy blunt hardly 1 mm. long. *Stylodes* very slender 5 mm. long.

The extreme vegetative forms of this species appear very different. The type of *E. Curtisii* from Penang had solitary rather small leaves and very slender inflorescences. The type of *E. latiflora* from Singapore had much larger leaves, five together, and a shorter inflorescence. The shape of the leaves is however very similar in all specimens, and the structure of the inflorescence with its solitary often stalked flowers and non-tubular bracteole, also the remarkable anther-crest, are identical in all specimens. There is a fair amount of variation in the length of the corolla-tube, and in the size of the corolla-lobe and anther-crest, but there do not appear to be distinct varieties in which such variations of different parts are clearly correlated. Further field study may show that such varieties exist, in which case it may be desirable to revive Ridley's name *latiflora;* but at present there is insufficient evidence to show that a clear distinction exists.

The inflorescence is branched in strong plants, as in *E. triloba*. The apical part of the inflorescence develops its flowers first, and then the branches in the axils of the basal sheaths afterwards. This behaviour is also matched in *E. triloba;* likewise the way in which the branches pierce the bases of the sheath-leaves in whose axils they arise.

Specimens. *Trengganu.* Ulu Bendong, Kemaman, 700 feet, S.F.N. 30014 (Corner). *Penang.* 1,000–1,500 feet, King's Collector 1706 (type of *E. serpentina*). Western Hill 2,500 feet, Curtis 1570 (type of *E. Curtisii*). Waterfall, Curtis s.n. May 1901. Near Crag Hotel, 1,700 feet, S.F.N. 751 (Burkill). Bukit Laksamana, Curtis 1705. Waterfall Hill, S.F.N. 3369 (Burkill). Behind Convalescent Bungalow, (Pg. Hill), Ridley s.n. March 1896. *Perak.* Bujong Malacca, Ridley 9789. *Selangor.* Klang Water Catchment forest, S.F.N. 6828 (Burkill). *Johore.* 14th mile Mawai-Jemaluang Road, Corner s.n. 8.9.1935. Kluang F.R., S.F.N. 9219 (Holttum). *Singapore.* Sungei Buloh, Ridley s.n. 1894. Bukit Timah, J.S.G. s.n. 12.2.1890; Ridley 5027. Kranji, Mat s.n. Ap. 1895 and s.n. 1899.

3. **Elettariopsis triloba** (Gagnep.) Loes., Pflanzenfam. Ed. 2 15A: 603. 1930. *Amomum trilobum* Gagnep. Bull. Soc. Bot. Fr. 1904: 453. Fl. Gen. Indoch. 6: 108, pl. IID, 25–30. **Fig. 29.**

Rhizome slender. *Leafy shoots* of 2–5 leaves, the longest sheath c. 25 to 60 cm. long; basal sheaths purplish. *Leaf-blade* grey-green, to about 35 cm. long and 4–7 cm. wide, glabrous, apex distinctly caudate (cauda c. 1–2·5 cm. long), base narrowed very gradually; petiole of lowest blade c. 1–3 cm. long, of uppermost to 10 cm.; ligule glabrous, barely 2 mm. long. *Flowering-shoot* from base of leaf-shoot, horizontal 2–15 cm. long, with an erect terminal inflorescence and often one or more lateral ones in the axils of the sheaths, the lateral inflorescence developing after the terminal one; sheaths on horizontal part of shoot 1·5–2 cm. long. *Inflorescence* of about 6–10 bracts in a compact head, or sometimes the lower bracts rather spaced. *Outer bracts* white, thin, 2·5 to 3 cm. long and to 2·0 cm. wide, inner ones smaller, broadly pointed, a few outer ones with single flowers, the rest usually with 2 flowers each. *Bracteoles* not tubular, 1–1·5 cm. long, enclosing the younger flower-bud only of each pair. *Calyx* 3·5–5·5 cm. long, rather wide, the 3 teeth usually very close together and hardly distinguishable, split about 1 cm. down the other side, glabrous except at the very tip. *Corolla-tube* about as long as calyx or up to 1 cm. longer; lobes to 2·2 cm. long, dorsal 8 mm., laterals 7 mm. wide. *Lip* c. 3 cm. long and 2·5 cm. wide, broadly rounded and 3-lobed, the edges thin and finely crinkled, the apex reflexed, cream with broad yellow median band and a red stripe on either side of it in the basal part, the midrib thickly fleshy, hairy towards the base. *Staminodes* nil. *Filament* c. 6 mm. long and 5 mm. wide. *Anther:* pollen-sacs c. 5 mm. long; crest c. 7 mm. long and 5 mm. wide, oblong, slightly concave, with a very small tooth-like lobe at the base on each side. *Stylodes* 5 mm. long, cream, not surrounding base of style, with about 5 slender lobes 2·5 mm. long. *Stigma* cup-shaped with a triangular opening, about 3·5 mm. wide: style slightly hairy, cream.

This species is vegetatively near *E. Curtisii* but has never such wide leaves and when well developed the composite leaf-stem (i.e. the leaf-sheaths folded together) is much longer; the petioles are also never so long and the ligule is always short. The inflorescence is like *E. Curtisii* in its prostrate axis and method of branching, but the flowers are in small compact erect heads, with much larger bracts (which are not 2-ranked), and never have long pedicels. Each bract has two flowers in its axil, or rarely even three flowers, the one opening first without a bracteole. If there is only one flower, the rudiment of another, in the axil of the bracteole, is always present. The corolla-tube is never greatly longer than the calyx, and the anther-crest is not so wide as in *E. Curtisii*, though it is as long. The stigma is larger, with a transversely widened triangular mouth. As in *E. Curtisii*, there is much variation in the length of

the flowers, depending probably on environmental conditions; this involves both calyx and corolla, not corolla only as in *E. Curtisii*. Burkill's specimen from G. Tampin is peculiar in having a short calyx which is copiously short-hairy all over. Perhaps it may represent a distinct variety.

Malayan specimens agree well with Gagnepain's description and figure, except that the peduncle of the inflorescence is sometimes longer (he says 2 to 7 cm.) and is often branched, and the floral bracts are usually longer (he says 1·5–2 cm. long). His figure of the stigma is perhaps distorted owing to preparation from dried material. He evidently only saw plants with their first inflorescences. It seems that the terminal inflorescence on the flowering shoot is produced first, while the scape is quite short, close to the base of the flowering stem. After this has flowered, the scape elongates more or less by intercalary growth, and the buds in the axils of the sheaths (which can be seen while the terminal inflorescence is flowering) develop each to a new lateral inflorescence. The scape is just at ground level, and travels laterally among the litter of leaves etc. on the ground-surface. Herbarium specimens thus sometimes show only small inflorescences on short scapes close to the base of the leaf-shoots, and sometimes prostrate branched inflorescences up to 15 cm. long. The calyx of this species is thin near the apex and shrivels a little when the corolla has passed it; the corolla-tube then often appears about 1 cm. longer than the calyx, but if the latter is stretched to its full length it is about equal to the corolla-tube. The range of the species is throughout Malaya and northwards to Indo-China (Saigon, Bassac in Laos, and Tourane in Annam; i.e. to 16° N. lat.); it doubtless also occurs in Siam and Tenasserim.

SPECIMENS. *Perak*. Lumut, Dindings, Ridley 10348, 17223. Hermitage Hill, Ridley s.n. 1892. The Cottage, Ridley s.n. 6.3.1892 Larut, 800–1,500 feet, King's Collector 2886 (doubtful). *Perlis*. Bukit Telor Jambu, Ridley 15192. *Kedah*. Kedah Peak, Ridley s.n. June 1893. *Pahang*. Tanah Runto, P. Tioman, 1,200 feet, S.F.N. 18381 (Henderson). *Selangor*. Sungei Buloh, J.S.G. s.n. October 1899. *Negri Sembilan*. G. Tampin 1,500 feet, S.F.N. 3160 (Burkill). *Johore*. G. Panti, 1,600 feet, S.F.N. 18088 (Holttum).

11. GEOCHARIS RIDLEY

Leafy shoots fairly tall, the leaf-sheaths with small cross-bars of white felted hairs between the ribs. *Inflorescence* separate from leaf-shoots, on a rather long slender, erect peduncle, the rachis erect or somewhat curved, the flowers spreading evenly on all sides, or secund. *Bracts* thin, rather small, each with a single flower in its axil. *Bracteole* thin, soon decaying, about as long as the calyx,

tubular (?) at the base. *Flower* shortly pedicelled. *Calyx* tubular, rather narrow, shortly 3-lobed and 3-toothed, split slightly down one side. *Corolla-tube* slender, as long as or longer than calyx, dorsal lobe longer and much wider than the laterals, all lobes much shorter than the tube. *Labellum* about as long as lateral corolla-lobes, narrow, 2-lobed nearly to the base, joined to the stamen to form a short tube above the bases of the corolla-lobes. *Stamen* with rather long broad concave filament, bearing a small tooth-like staminode on either side near the anther; anther narrower, with a small hood-shaped appendage at the apex. *Stylodes* very short, fleshy. *Fruit* ellipsoid, large, warty, the walls fleshy, with persistent calyx at its tip; seeds many, angled, each covered with a thin fleshy aril.

Schumann made a section Geocharis in the subgenus Rhizalpinia of the genus Alpinia. This section included *A. macrostemon* Schum. from Sumatra and *A. decurva* Ridl. from New Guinea. Ridley found in Johore a plant which he considered related to these, and adopted Schumann's name Geocharis to found a new genus for his species, *G. aurantiaca*. He stated that he considered all three species to be probably congeneric, and distinct from Alpinia, but he did not make any new combinations. He noted a resemblance to the Papuan genus *Riedelia*. He also described another Geocharis from Sarawak, *G. rubra*.

In the same publication, Ridley described a new species *Alpinia secundiflora*, from a specimen collected by Kelsall. He did not see the living plant, and so did not realize that the inflorescence was not terminal. I collected the same (or at least a closely similar) species on G. Tampin, and thus showed its identity with Geocharis. Ridley's original species had an erect symmetrical inflorescence; this second Malayan species had the flowers all pointing to one side, as in Schumann's Sumatran species.

It seems clear that these four species all belong to one genus, and that genus is not Alpinia, unless Alpinia is so enlarged as to become meaningless. Ridley's generic name is the valid one, and we have:—

Geocharis aurantiaca Ridl.

G. rubra Ridl.

G. secundiflora (Ridl.) Holtt. **comb. nov.** (Alpinia secundiflora Ridl.).

G. macrostemon (K. Schum.) Holtt. **comb. nov.** (Alpinia macrostemon Schum.).

Alpinia decurva Ridl. is probably a true Riedelia, in which genus it has been placed by Valeton.

If Valeton is correct in stating that Riedelia species always have a deciduous calyx, then the above species of Geocharis are certainly distinct from Riedelia. They agree strikingly with Riedelia however in the deeply-bilobed narrow lip which is joined to the stamen in a short tube above the attachment of the corolla-lobes.

In character of inflorescence, Geocharis has somewhat the aspect of Cenolophon, the flowers being all borne singly, and it has also elongated fruits; but it appears to have tubular bracteoles (though this needs to be confirmed) and also the lip is very different from Cenolphon. In the remarkable cross-bars between the ribs of the leaf-sheaths, Geocharis exactly matches *Hornstedtia scyphifera* and allied species.

Geocharis agrees with Geostachys in having the inflorescence on a separate shoot from the leaves, and also in having erect symmetrical and decurved secund inflorescences within the genus; but again the lips of the two genera are very different, and Geocharis has solitary flowers.

There is little doubt that Geocharis is related to Alpinia and to Riedelia, probably more nearly to the latter, of which it may ultimately rank as a section. The only known species of Geocharis are in Western Malaysia, whereas Riedelia is centred in New Guinea. Probably species from Celebes and other intermediate countries will throw more light on the relationships of the two groups.

KEY TO GEOCHARIS IN MALAYA.

Flowers on inflorescence spreading in all directions
1. *G. aurantiaca.*
Flowers all pointing in one direction 2. *G. secundiflora.*

1. **Geocharis aurantiaca** Ridl., J.S.B.R.A.S. 5.: 144. 1908. Flora 4: 273. *Riedelia aurantiaca* Loes., Pflanzenfam. Ed. 2, 15A: 627. 1930.

Rhizome 1 cm. thick or rather more, just below ground surface; scale leaves when young cross-barred like the leaf-sheaths. *Leafy shoots* 10–20 cm. apart, to 2 m. or rather more tall, basal 30–60 cm. leafless, 3–4 small leaves below full-sized leaves; sheaths dark green, slightly scabrid, with irregular small horizontal white bars joining the longitudinal ribs. *Leaves* dark green, blade minutely hairy on the midrib and hairy on the edges beneath, otherwise glabrous, commonly to about 35 by 7·5 cm., exceptionally to 10 cm. wide, apex shortly acuminate, base cuneate or sometimes almost rounded; *petiole* to 2 cm. long, very short-hairy; *ligule* to 1 cm. long, short-hairy. *Inflorescences* arising at base of leaf-shoots or from rhizome between leaf-shoots. *Peduncle* erect, slender, 25–40 cm. tall, covered with 2-ranked sheaths which are shortly tubular at the base, the upper ones longest, to 10 cm. long,

scabrid and cross-barred like the leaf-sheaths. *Rachis* of inflorescence erect, slender, minutely hairy, elongating gradually to 15–25 cm., bearing many flowers on all sides (not secund). *Bracts* very thin, soon becoming broken, apparently to about 5 mm. long (longer in lower flowers). *Bracteole* joined to pedicel, very thin and soon breaking, apparently as long as the calyx, apparently tubular at the base. *Pedicel* about 2–3 mm. long at flowering, 6 mm. at fruiting; ovary minutely warty. *Calyx* with ovary c. 3·5–4 cm. long at flowering, the apex 3-lobed, the lobes subequal, 5 mm. long, each with a slender hairy tip 2 mm. long. *Corolla-tube* as long as calyx; lobes oblong, orange, the dorsal one about 2·4 cm. long, erect, concave, fitting round the stamen, about 1 cm. wide when flattened, laterals a little shorter, narrower, close together below the lip. *Tube* of flower densely hairy within. *Lip* about as long as corolla-lobes, crimson with yellow edges, deeply 2-lobed, lobes narrower than corolla-lobes with acute tips. *Filament* 1 cm. long, broad, concave, as wide as dorsal corolla-lobe which encloses it, with a short forward-curved tooth on each side just below the anther. *Anther* about 7 mm. long, erect, very broad, with a small hooded appendage at the apex 1 mm. long. *Stylodes* very short, blunt, pale violet- (Ridley). *Fruit* narrowly ellipsoid, about 6 cm. long and 2·5 cm. thick, with 6 rounded ridges, entirely covered with irregular warty outgrowths 2–3 mm. high and wide, crowned with the persistent calyx, green when nearly ripe, wall fleshy; seeds may in each loculus, 6–7 mm. long, angled, entirely covered with a thin fleshy aril.

SPECIMENS. *Johore.* Tempayan river, Kukub, Ridley 13271 (Type). Kluang-Mersing Road at 7th Mile, S.F.N. 9283 (Holttum). Sungei Kayu, Mawai-Jemaluang Road, S.F.N. 32454, 32777 (Corner).

This species has only been found in fresh-water swamp-forest in Johore, at three rather widely separated localities. It has slender erect inflorescences with the flowers symmetrically arranged. Ridley described the flower from an unopened bud; his description is therefore admittedly incomplete. The measurements of the parts given above are taken from a specimen preserved in alcohol (S.F.N. 32446). This shows excellently the peculiar concave very broad filament (shaped like half a hollow cylinder) closely enclosed by the dorsal corolla-lobe. The lip and stamen are joined together in a tube about 5 mm. above the base of the corolla-lobes. The colour notes are taken from Ridley. Further field notes are needed, and especially the examination of young inflorescences, so that clear information about the shape and size of bracts and bracteoles may be obtained, as these are not included in the alcohol material available.

2. **Geocharis secundiflora** (Ridl.) Holtt., **comb. nov.** *Alpinia secundiflora* Ridl., J.S.B.R.A.S. 32: 165. 1899. Flora 4: 278.

Leaf-shoots to 2 m. tall; basal sheaths with rather regular cross-flecks of white. *Leaves* to 43 by 10 cm., glabrous except

for hairy edges beneath, apex shortly acuminate, base cuneate; petiole to about 5 mm. long; ligule densely short-hairy or glabrescent, 5–9 mm. long; sheaths with very broad close white cross-bars near the petiole. *Peduncle* erect or with a curved base, probably to more than 30 cm. tall, sheaths with close and rather regular white cross-bars, longest sheath up to 15 cm. long. *Rachis* 20–30 cm. long when old (the lower part then flowerless), somewhat decurved, bearing closely placed secund flowers, short-hairy. *Bracts* very thin, to at least 7 mm. long. *Bracteoles* apparently as in *G. aurantiaca*. *Pedicel* at flowering 4–6 mm. long; ovary distinctly warty, not hairy. *Calyx* with ovary 2·6 cm. long, slender, the teeth little over 1 mm. long, hairy, otherwise glabrous, split 8 mm. down one side. *Corolla-tube* 3·5 cm. long, hairy inside, with lobes deep yellow; dorsal lobe 1·8 cm. long and about 8 mm. wide, laterals 1·5 cm. long and about 4 mm. wide. *Lip* joined to stamen for a short distance beyond end of corolla-tube, about 1·6 cm. long, lobed nearly to the base, the lobes apparently about 2 mm. wide near the base, narrowing to the apex, deep orange, the edges paler. *Filament* about 1·2 cm. long, basal part 6 mm. wide, abruptly narrowed to 3 mm. near the apex, with a small tooth each side. *Anther* 8 mm. long, with a small concave rounded apical crest about 1·5 mm. long and wide. *Stylodes* broad, fleshy, little over 1 mm. long. *Fruit* not known.

This species is very nearly related to *G. aurantiaca*, but appears to differ constantly in its secund inflorescence. The calyx appears also to be shorter and the corolla-lobes smaller, but the measurements are made from dried material and may be too small. It is a species of moderate elevations in the hills, not of swampy lowland forest. The floral details are taken from G. Tampin specimen, which matches the type well in observable characters. The type has however a stouter rachis, longer pedicels, and a short-hairy ovary which is ridged rather than warty. Perhaps we have two species here. It seems clear that Ridley's "staminodes" which he reports as 1 inch long are the two lobes of the lip.

Specimens. *Selangor.* Bukit Etam, Kelsall s.n., January 1891 (Type). *Negri Sembilan.* Gunong Tampin, 2,000 feet, S.F.N. 9575 (Holttum). *Kelantan.* Gua Ninik, S.F.N. 19678 (Henderson).

12. GEOSTACHYS Ridley

Rhizome stout or fairly stout, often supported above ground level on thick stilt-roots, sometimes in contact with ground surface, never buried. *Leafy shoots* often very close together, giving the plant a tufted habit, the false stem 40 cm. to 3 m. tall; leaves narrow or broad, glabrous or hairy, the ligule fairly large, broad, entire. *Peduncles* from the base of the leafy shoots, erect at the base, often curved near the apex, completely covered with closely overlapping 2-ranked sheaths, the basal sheaths small, the upper ones as long as the peduncle itself, or nearly so.

Rachis of inflorescence 5–20 cm. long, erect or bent more or less steeply downwards, bearing many short cincinni in the axils of small (rarely large) primary bracts. *Cincinni* arranged symmetrically on all sides of erect inflorescences, or all bent upwards (secund) in decurved inflorescences, each cincinnus bearing 2–5 flowers in close succession, their bracts and calyces extending little beyond the first floral bract. *Floral* (*secondary*) *bracts* inflated-tubular, breaking open near the apex only, usually with a small hairy tooth just below the apex, each bract entirely enclosing both the first flower and the next bract with its contents. *Flower* shortly pedicelled, the ovary glabrous. *Calyx* about as long as the bract which encloses it, in many species with a single slender point about 5 mm. long, sometimes with two rather broad lobes, usually split about 5 mm. from the apex. *Corolla-tube* a little shorter than the calyx; lobes oblong, about as long as the tube, the dorsal one wider than the laterals, with concave apex. *Labellum* about 1½ times as long as the corolla-lobes, more or less distinctly 3-lobed, the side-lobes usually erect, triangular, smaller than the broadly rounded and somewhat reflexed midlobe, usually dull yellow, often marked with pink or red (sometimes white instead of yellow). *Staminodes* usually absent, sometimes present as small lobes at the base of the lip (?). *Stamen* with broad filament and anther of about equal length, the connective of the anther sometimes produced to form a simple or 3-lobed crest. *Stigma* small, cup-shaped, the orifice fringed with hairs, usually standing well above the apices of the pollen-sacs. *Stylodes* short, fleshy, blunt. *Fruit* red, smooth, ellipsoid or almost round, 1–3 cm. long.

The species of this genus are all mountain plants. Most of them have the rhizome supported on stilt-roots and the inflorescences decurved, with the flowers all bent upwards, thus giving the plants a very characteristic appearance. But there are other species, agreeing in every other character, which have quite erect inflorescences with the flowering branches spreading equally all round them.

The really distinctive characters of the genus are the short or fairly short inflorescence from the base of the leafy shoots, the peduncle covered with closely overlapping relatively large sheaths, and the short cincinni each in the axil of a (usually very small) bract, each flowering bract completely enclosing both the next flower and the next flowering bract. The inflorescence-structure, apart from its position on a short shoot from the base of a leaf-shoot, is exactly that of Alpinia in the restricted sense here used, and the original position given to the genus as a section of the large large genus Alpinia, by Baker in the Flora of

British India, was quite a natural one. If we could elongate the peduncle and turn its sheaths into foliage-leaves, Geostachys would become Alpinia; and when the correct generic name for the species here called Alpinia is established, the question of uniting them with Geostachys should be considered.

Ridley included seven species in Geostachys. In addition to these, his *Conamomum sericeum* and *Carenophila montana* clearly belong to this genus. Three new species are now also added, one based on specimens from G. Tahan which Ridley wrongly referred to *G. rupestris,* one on a specimen from Taiping Hills wrongly named by Ridley *Conamomum utriculosum,* and one on a remarkable and very large plant found at 6,000 feet on G. Batu Brinchang.

Several of the species are rather closely allied, and it may later appear preferable to reduce one or more to the rank of varieties; on the other hand, it seems quite likely that other new species may be discovered. There is little doubt that some at least of the species are very local in their distribution. Of the twelve species, nine are known from one locality only. Of the other three, *G. elegans* has been found on Mt. Ophir and on three different mountains in Pahang, *G. penangensis* on Penang Hill and rather doubtfully at Cameron Highlands, and *G. densiflora* (again with some doubt) on G. Kerbau, at Cameron Highlands and on Fraser's Hill. *G. elegans* is thus the most widely distributed species.

The floral form is very constant throughout the genus, but the anther-crest is variable and perhaps would afford the best distinguishing character for individual species, if we had full information. The primary bracts are probably useful, being extremely small in some species, and in one species very large. The vegetative habit of the plants, width and pubescence of leaves, are very distinctive in most cases, as also the size, habit and density of the inflorescence.

KEY TO THE MALAYAN SPECIES OF GEOSTACHYS

Inflorescences with cincinni spreading evenly on all sides (never secund), the rachis, like the peduncle, usually erect but sometimes slightly curved, never strongly deflexed

Leaves to 5 cm. wide, ligule and lower surface glabrous 1. *G. elegans.*

Leaves much wider, ligule or lower surface, or both, densely hairy

Leaves glabrous beneath, except for the edges

Lip nearly 3 cm. long, pale pink, streaked darker in the throat; leaves to 20 cm. wide
2. *G. megaphylla.*
Lip about 1·5 cm. long, pale yellow, side-lobes spotted pink at base; leaves to 12 cm. wide
3. *G. sericea.*
Leaves copiously hairy beneath
Ligule densely long-hairy; primary bracts 7–12 mm. long; flowering bracts not over 2 cm. long
4. *G. montana.*
Ligule glabrous (or quite glabrescent); primary bracts to 3 cm. long; flowering bracts 2·5 cm. long
5. *G. taipingensis.*

Inflorescence with deflexed rachis, the cincinni all secund, pointing upwards
Rachis of inflorescence not over 7 cm. long
Lip yellow with red spots; anther with a small round crest
6. *G. rupestris.*
Lip without red spots; anther without crest
Leaves not more than 4 cm. wide
7. *G. penangensis.*
Leaves to 8 cm. or more wide
Leaves about 4 to each leaf-shoot, midrib glabrous, blades to 25 by 8 cm.; rachis of inflorescence glabrous
8. *G. tahanensis.*
Leaves to 45 by 11 cm. (and probably also longer); midrib hairy beneath; rachis hairy
9. *G. primulina.*
Rachis of inflorescence much longer on well-grown plants
Leaves to 12 cm. wide
10. *G. secunda.*
Leaves much narrower (to about 5 cm.)
Inflorescence lax (about one cincinnus per cm. of length), rachis glabrous
11. *G. decurvata.*
Inflorescence dense (about 3 cincinni per cm. of length), rachis hairy
12. *G. densiflora.*

1. **Geostachys elegans** Ridl., J.S.B.R.A.S. 32: 160. 1899. Flora 4: 277.

Rhizome supported on stilt-roots; bearing densely tufted leaf-shoots. *Leaf-shoots* to 120 cm. or more tall to apex of longest sheath; leaves to about 10. *Leaves:* blade to about 45 by 4·5 cm. (often narrower), glabrous, dark purple beneath when young, apex narrowly acuminate, base cuneate; petiole 5–10 mm. long; ligule to 5 mm. long, glabrous. *Peduncle* slender, 15–30 cm. long, erect covered with rather few long sheaths,

longest to 17 cm. or more long. *Rachis* erect, densely short-hairy, about 10 cm. long, bearing c. 20 cincinni. *Primary bracts* 1–2 mm. long; longest stalk of cincinni 5–7 mm. long, short-hairy. *Outer flowering bracts* 1·3–2 cm. long, glabrous or finely hairy, especially towards the base, containing 2 flowers. *Calyx* with ovary c. 1·4 cm. long. *Corolla-lobes* c. 9 mm. long, buff (Ridley). *Labellum* 1·5 cm. long, orange yellow (Haniff). *Anther* apparently with a small crest. *Fruit* orange red, almost spherical, glabrous and slightly ribbed, about 1·5 cm. long.

SPECIMENS. *Malacca.* Mt. Ophir, 3,800 feet, Ridley 3137 (Type); Ridley s.n. December 1898. Bukit Kedondong, Derry 603. *Pahang.* G. Tapis, Kuantan, 4,000 feet, S.F.N. 28863 (Symington and Kiah). G. Benom, 6,000 feet, F.M.S. Coll., 20.7.1925. G. Tahan, Ridley 15942; 5,500–7,000 feet, S.F.N. 7968 (Haniff and Nur).

This species has been found at more different localities and over a wider area, than any other in the genus. Its slender erect inflorescence is very much like that of *G. sericea* (from G. Tahan only) but is smaller, and it always has narrow leaves, red beneath, glabrous ligule, and different details of the flower as specified under *G. sericea*. With some of the collections there are no notes of flower colour, and no good flower-material, so that local varieties may exist. There can however be little doubt that the G. Tahan and Mt. Ophir plants are conspecific. Derry's locality Bukit Kedondong is not a high hill; no other lowland records exist for the species, nor for any other in the genus.

2. **Geostachys megaphylla** Holtt., **sp. nov.**

Rhizoma validus, radicibus gralliformibus validis sustentus; *caules foliati* 300 cm. alti; *lamina folii* ad 80 cm. longa et 20 cm. lata, marginibus exceptis glabra, apice abrupte angustata brevissime acuminata, basi late cuneata; *petiolus* 10–15 mm. longus; *ligula* 15 mm. longa, lata, dense hirsuta; *vagina* margine hirsuta; *inflorescentia* erecta, scapo 12 cm. longo sustenta, rachis c. 8 cm. longa; bracteae primariae parvae, tenues; *cincinni* flores 4 ferentes, pedicellis glabris 5 mm. longis donati; *bracteae secundariae* 2–2·3 cm. longae, apice paulo hirsuto excepto glabrae; *calyx* cum ovario 2·2 cm. longus, apice bilobatus, lobi fere aequales, apicibus brevibus hirsuti; *ovarium* 4 mm. longum, rubrum; *corollae* tubus quam calycem leviter brevior, lobi 2·2 cm. longi, lobus dorsalis 15 mm. latus, pallide rubicundus, lobi laterales 10 mm. lati; *labellum* tenuissimum, pallide rubescens, fauce striis rubris ornatum, fere 3 cm. longum, trilobatum, margine crispatum; *filamentum* 10 mm. longum; *anthera* 8–10 mm. longa, crista connectivi pallide carnea, trilobata, lobo intermedio petaloideo 7–8 mm. longo et lato, rotundato, marginibus irregularibus, lobis lateralibus patentibus 3 mm. longis et 2 mm. latis; *stigma* supra antheram longe exsertum, parvum, cyathiforme, apice haud 2 mm. latum; *stylodia* carnosa, obtusa, 2 mm. longa; *fructus* ellipsoideus, atro-ruber, glaber, 2·3 cm. longus, 2·0 cm. diametro. TYPUS: Pahang, Cameron Highlands, G. Batu Brinchang, 6,000 feet, S.F.N. 31276, leg. Holttum 15.5.1936.

This remarkable species is known only from the type collection. The details of the description are taken from dried and alcohol material and from field notes. It appears

to be closely allied to *G. sericea* from G. Tahan, but differs in the much larger leaves, glabrous bracts, larger lip of different colour, and larger anther-crest. It probably differs also in having a shorter peduncle, but this is uncertain. It agrees with *G. sericea* and *G. montana* in the densely hairy ligules of the leaves, a character otherwise unknown in Malayan species of Geostachys.

3. **Geostachys sericea** (Ridl.) Holtt., **comb. nov.** *Conamomum sericeum* Ridl., Journ. F.M.S. Mus. 6: 185. 1915. Flora 4: 255.

Rhizome large, stilted. *Leafy stems* 1·20–2·50 m. tall (Ridl. says 8 feet, Holtt. 4 feet). *Leaves* to 60 by 12 cm., glabrous; apex shortly pointed, base rather narrowly cuneate; petiole 0·5–1·5 cm. long, glabrous; ligule to 1·2 cm. long, densely short-hairy all over. *Peduncle* erect, to 25 cm. tall, rather stout, short-hairy towards the apex; sheaths broad, to 15 cm. long. *Rachis* erect, to about 14 cm. long, densely short-hairy, bearing very many closely packed cincinni. *Primary bracts* usually to about 5 mm. long; in some specimens the basal ones very much larger, up to the length of the flowering bracts: stalks of cincinni to 7 mm. long, densely short-hairy. *Outer flowering* bracts to about 2·3 cm. long, minutely hairy all over, containing 2 or 3 flowers. *Calyx* broad, with ovary c. 1·5 cm. long, hairy towards the tip. *Corolla-lobes* about 1·2 cm. long, pale pink or white. *Labellum* about 1·5 cm. long (?), pale yellow, the midlobe rather deeper in colour, the side-lobes spotted with pink at the base. *Filament* c. 5 mm., anther c. 6 mm. long; anther-crest 3-lobed, white flushed and spotted with pink, side-lobes spreading, narrow, about 2 mm. long, midlobe broad, rounded, about 3 mm. long and wide. *Fruit* ellipsoid, ribbed, smooth, at least 1 cm. long (probably longer).

This species has only been found on Gunong Tahan, at about 5,000 feet altitude. It is closely allied to *G. elegans*, but attains a larger size, has much larger and wider leaves, very hairy ligules, and a much denser inflorescence with rather larger floral bracts, longer corolla-lobes, the lip differently coloured and the anther-crest large, 3-lobed.

SPECIMENS. *Pahang*. G. Tahan, Ridley 15943 (Type); 5,000 feet, S.F.N. 20663 (Holttum); 4,500–6,000 feet, S.F.N. 8133 (Haniff and Nur). Corner, s.n. 15.9.37.

4. **Geostachys montana** (Ridl.) Holtt., **comb. nov.** *Carenophila montana* Ridl., Journ. F.M.S. Mus. 4: 78. 1909. Flora 4: 256.

Leafy stems to 100 cm. tall and possibly to 150 cm. *Leaves* densely soft-hairy beneath, the hairs over 1 mm. long, spreading; blade to about 45 by 8 cm., upper surface glabrous, apex shortly acuminate, base cuneate; *petiole* very short, densely covered like the midrib with longer hairs than those on the leaf-blade. *Ligule* 5–7 mm. long, densely yellow hairy; *sheath* hairy down the edges and on the back below the petiole.

Peduncle 5–7 cm. long, longest sheath c. 8 cm. long, broad, pink (Ridley). *Rachis of inflorescence* c. 6 cm. long, somewhat decurved, hairy, completely covered with the very numerous crowded cincinni which are not secund. *Primary bracts* 7–12 mm. long, very thin, apex rounded, hairy at base and on edges. *Stalks* of cincinni c. 4 mm. long. *Outer flowering bracts* pink, to 2 cm. long, hairy towards tip, containing 2 or 3 flowers. *Calyx* with ovary 2·3 cm. long, 2-lobed, sparsely hairy throughout, densely so at apex, ovary glabrous except for a few hairs at the base. *Corolla-tube* 5 mm. shorter than calyx, pink; lobes 1·5 cm. (? to 2 cm.) long, hairy outside, white. *Labellum* little longer than corolla-lobes, "entire, edges upcurved", "white speckled with red" (Ridl.) with basal lateral lobes 4 mm. long (called staminodes by Ridley). *Filament* 6 mm. long; anther (apart from crest) 6 mm. long; crest thin, round, 4 (or ? 5) mm. long and wide. *Stigma* cup-shaped, 2 mm. wide, the mouth fringed with hairs. *Fruit* broadly ellipsoid, when dry 1·5 cm. long, glabrous, with many small longitudinal ridges, when fresh smooth, red (Ridl.).

This species is only known from the type, collected on the summit of G. Berembun (alt. 6,500 feet) in November 1908 by Mr. Ridley. It differs from the other species of Geostachys in its very hairy leaves (agreeing with *G. sericea* and *G. megaphylla* in the very hairy ligule), in the hairy corolla-lobes and small basal lobes of the lip. Its inflorescence is essentially of the same shape as that of *G. elegans* and *G. sericea* but very much shorter and apparently is somewhat decurved instead of erect (this is not mentioned by Ridley and may be due to uneven drying of the specimen). The primary bracts are rather large, but they are occasionally so in the allied species. The only possible reason for making a new genus of this species (which agrees exactly in inflorescence-characters with Geostachys) is the presence of the basal lobes of the lip, which Ridley calls staminodes; I think however that a comparison of fresh material will show them to be very similar to the lateral lobes of the lips of other species, but smaller.

5. **Geostachys taipingensis** Holtt., **sp. nov.**

Caules foliati alti, validi; *lamina* folii ad 80 cm. longa et 15 cm. lata, infra dense et molliter hirsuta, capillis costalibus eis laminae non longioribus, apice breviter acuminata, basi cuneata; *petiolus* 1 cm. longus, validus, subtus breviter hirsutus; *ligula* ad 2·3 cm. longa, lata, firma, glabra (vel glabrescens); *vagina* prope petiolum leviter hirsuta, marginibus glabris; *pedunculus* 7 cm. longus, erectus vel suberectus, vaginis latis ad 6 cm. longis vestitus; *rachis* erecta, c. 9 cm. longa, capillis patentibus dense vestita; *cincinni* numerosi, quaquaversi, rachin obliterantes; *bracteae primariae* tenues, ad 4 cm. longae et 1 cm. latae, apicem et basin versus solum leviter hirsutae; *pedicelli* cincinnorum ad 7 mm. longi, breviter hirsuti; *flores* 2–4; *bracteae secundariae* primae 2·5 cm. longae, omnino breviter hirsutae; *ovarium* glabrum; *calyx* cum ovario c. 2 cm. longus, apice unico donatus, 5 mm. fissus, sparse hirsutus; *corollae* tubus extus hirsutus, lobi c. 15 mm. (?)

longi, extus pilosi; *anthera* 8 mm. longa, crista parva rotundata (?); *stylodia* carnosa, obtusa, 2 mm. longa. TYPUS: Perak, Taiping Hills, Anderson 139, *pro parte* (in herb. Singap., sub nomine *Conamomum utriculosum* Ridl.).

This large species is near *G. megaphylla* in the size of its leaves, but they are hairy, whereas the ligule (densely hairy in *G. megaphylla*) is glabrous. The primary bracts, at least to half way up the inflorescence, are very large (the apical ones are probably shorter) as sometimes occurs also in *G. sericea*, with which *G. taipingensis* agrees in its hairy flowering bracts. The details of the flower are unfortunately not well preserved (the details of dimensions are thus doubtful), but the species is undoubtedly quite distinct from all others so far known in Malaya. Of Anderson's no. 139 there are two sheets in the Singapore herbarium. One is *Amomum utriculosum* (Ridl.) and the other is the present species. Whether any specimens bearing this number have been distributed to other herbaria is not known.

6. **Geostachys rupestris** Ridl., J.S.B.R.A.S. 32: 159. 1899. Flora 4: 276.

Rhizome supported on stilt-roots. *Leafy shoots* to about 100 cm. to top of the longest sheath. *Leaves* to 35 by 7 cm., glabrous, apex acuminate, base rather broadly cuneate, unequal; *petioles* to 4 cm. long, slender; *ligule* to 8 mm. long, glabrous. *Peduncle* 4–8 cm. long, longest sheath to about 7 cm. *Rachis* of inflorescence short-hairy, to about 6 cm. long with up to 20 cincinni. *Primary bracts* hardly over 1 mm. long: stalks of cincinni to 1 cm. long; flowers 2–3 in each cincinnus. *Floral bracts* glabrous, outer ones 1·8–2·5 cm. long. *Calyx* c. 1·3 cm. long. *Corolla-lobes* c. 1 cm. long. *Lip* yellow with red spots. *Anther* with a small rounded crest, without spreading side-lobes.

This species has only been found on the upper part of Kedah Peak, in the zone dominated by Baeckia and Leptospermum. It is moderately tall, has leaves of width intermediate between the narrow and broad-leaved species, a short but dense inflorescence, with very short primary bracts, rather small flowers with red-spotted lip, and a small simple anther-crest. Mr. Ridley included with this species some specimens from G. Tahan, which differ however in several characters and are as distinct as most species in this genus; they are now re-named *G. tahanensis*.

SPECIMENS. *Kedah.* Kedah Peak, 3,000–4,000 feet, Ridley s.n. June 1893 (Type); 3,500 feet, Haniff 12584.

7. **Geostachys penangensis** Ridl., J.S.B.R.A.S. 32: 159. 1899. Flora 4: 276.

Rhizome at or close to ground level, not on stilt-roots. *Leaf-shoots* to 55 cm. tall to top of longest sheath, with 5–8 leaves. *Leaves* to 33 by 4 cm., often as long but narrower,

glabrous, apex acuminate and shortly caudate, base narrowly cuneate; petiole of lowest leaf 5 mm., of uppermost to 3 cm., slender; ligule to 7 mm., glabrous. *Peduncle* 2·5–5 cm. long, longest sheath c. 5 cm. *Rachis* glabrous, to 7 cm. long, with up to about 12 cincinni. *Primary bracts* 2–3 mm. long; stalks of cincinni 5–10 mm. long. *Outer flowering bracts* 2–2·7 cm. long, glabrous, each enclosing 2–4 flowers. *Calyx* c. 2 cm. long. *Corolla-lobes* reddish, 1·3 cm. long. *Labellum* about 2 cm. long, narrower than long, dull yellow. *Filament* 5 mm., anther 6 mm. long, without crest.

This species appears to be common on Penang Hill. The only specimen from outside Penang is one collected by Ridley at Telom (i.e. near Cameron Highlands), with young fruits; so far as it goes, this matches Penang specimens quite well. Specimens collected on G. Tahan agree well in inflorescence-characters, but have fewer leaves which are shorter and usually more than twice as wide. I rank them as a separate species.

SPECIMENS. *Penang.* Government Hill, 2,000 feet, Curtis 327 (Type). Moniot's Road, Curtis 327 (1892). Tiger Hill, 2,400 feet, S.F.N. 2650 (Burkill). Penang Hill 2,500 feet, Ridley 9336. *Pahang.* Telom, Ridley s.n., November 1908.

8. **Geostachys tahanensis** Holtt., **sp. nov.**

Rhizoma in terram repens, radicibus gralliformibus nullis; *caules foliati* c. 40 cm. alti, 4–5 foliati; *lamina folii* ad 25 cm. longa et 8 cm. lata, glabra, apice breviter acuminata, basi anguste cuneata; *petiolus* ad 2 cm. longus (interdum petiolus folii apicalis longior); *ligula* ad 7 mm. longa, glabra; *pedunculus* 5–7 cm. longus, vaginis biseriatis vestitus, vagina maxima 7 cm. longa; *rachis* decurvata ad 5 cm. longa, glabra, 7–12 cincinnos ferens; *bracteae primariae* 3–5 mm. longae; *cincinni* 2–3 flores ferentes, pedicellis 8 mm. longis donati; *bracteae secundariae* 2–2·8 cm. longae, glabrae; *calyx* cum ovario 18 mm. longus; *corollae* lobi 13 mm. longi, lobus dorsalis 7 mm. latus, lobi laterales 6 mm. lati, extus rubri, intus pallidi; *labellum* 22 mm. longum, 16 mm. latum, pallide luteum, nervis pellucidis; *filamentum* 4 mm. longum, anthera 6 mm. longa, crista nulla; *stylodia* brevia, obtusa; *fructus* non visus. TYPUS: *Pahang,* G. Tahan, 3,000–3,500 feet, near Sungei Reriang, S.F.N. 20582, leg. Holttum. OTHER SPECIMENS: Wray's Camp, 3,300 feet, Ridley 16286, 16287.

This species was referred by Ridley to *G. rupestris* (only otherwise known from Kedah Peak); but it differs from *G. rupestris* in being shorter (only half as tall) with shorter and proportionately broader leaves, shorter glabrous rachis with fewer cincinni, longer primary bracts, longer floral bracts, larger flowers lacking anther-crest and lacking red spots on the lip. The G. Tahan specimens were all collected at the same locality. They constitute a species which is most nearly related to *G. penangensis*, but quite as distinct as most others in the genus. Ridley's no. 16287 differs from the other specimens in having the inflorescence almost erect, the flowering branches spreading all round,

not on one side only. This may be due to some unusual environmental condition. Further details of the variation in size of the plants, and of floral characters, are needed to establish clearly the distinction from *G. penangensis*.

9. **Geostachys primulina** Ridl., J.S.B.R.A.S. 82: 201. 1920. Flora 4: 277.

Leafy stems tall. *Leaves* to 45 by 11 cm. or more, with spreading hairs on the midrib beneath, apex shortly acuminate, base rather broadly cuneate, slightly and unequally decurrent; petiole 1–1·5 cm. long, hairy beneath or glabrescent; ligule to about 1·3 cm. long, broad, hairy or glabrescent; sheaths hairy near petiole only. *Peduncle* c. 4 cm. long, erect at base, apex decurved; largest sheath c. 5 cm. long. *Rachis* c. 6 cm. long, conspicuously hairy, hairs a little over 1 mm. long; cincinni to about 14. *Primary bracts* little over 1 mm. long; stalks of cincinni to 6 mm. long. *Outer flowering bracts* 2–2·5 cm. long, glabrous containing 2 (? 3) flowers. *Calyx* with ovary c. 2 cm. long. *Corolla-lobes* 1·2 cm. long, primrose yellow. *Anther* without crest.

This species is only known from the type collection, from Semangkok Pass (The Gap), Ridley 12029. It is evidently a large species vegetatively; the leaf preserved is one of the lower ones, and upper ones might be longer, though probably not wider. The inflorescence-characters, except the conspicuous hairs on the rachis, are those of *G. penangensis*. The colour of the lip has not been reported, nor is its size clearly distinguishable from the available material; it is likely however that a red-spotted lip would have been noted by Mr. Ridley, who notes the primrose yellow colour of the petals.

10. **Geostachys secunda** (Bak.) Ridl., J.S.B.R.A.S. 32: 158. 1899. Flora 4: 276. *Alpinia secunda* Bak., F.B.I. 6: 257. 1892.

Leaves to 80 by 13 cm., glabrous, apex acuminate; petiole c. 3 cm., ligule 1 cm. long, glabrous. *Peduncle* 10 cm. long (Ridley); rachis to 20 cm. long, with short spreading hairs; cincinni very numerous, their stalks also hairy, the whole inflorescence very dense. *Primary bracts* about 1 mm. long (much wider than long); stalk of cincinni to nearly 3 cm. long. *Flowering bracts* glabrous, 2–3 cm. long, each with 2–4 flowers. *Calyx* about 2 cm. long. *Corolla-lobes* about 1·3 cm. long. *Lip* about 2 cm. long (? 2·5 cm.). *Anther* 8 mm. long, without crest.

The type collection of this species (Kunstler 8047) is not represented in the Singapore herbarium. The above brief description is taken from a specimen of Ridley's which he refers to the species. It has much larger leaves than Baker described (he says 2 inches wide = 5 cm.). The flowers are in a fairly good state of preservation, and show no anther-crest. The very dense inflorescence is large,

with long stalks to the cincinni, and unusually short primary bracts. It may be that Ridley's specimen represents a distinct species.

SPECIMEN. *Perak.* Bujong Malacca, Ridley 9785.

11. **Geostachys decurvata** (Bak.) Ridl., J.S.B.R.A.S. 32: 158. 1899. Flora 4: 276. *Alpinia decurvata* Bak., F.B.I. 6: 257. 1892.

Leafy shoots to 1·5 m. tall. *Leaves* deep green, glabrous, to about 60 by 5 cm., apex acuminate, hardly cuspidate, base cuneate; petiole 2–4 cm. long, ligule to about 1·2 cm., glabrous. *Peduncle erect,* curved near apex only, 10–25 cm. long; sheaths to about 10 cm. long. *Rachis* c. 12–20 cm. long, bearing up to about 22 cincinni, glabrous. *Primary bracts* usually 2–3 mm. long. *Stalks of cincinni* 1–2·5 cm. long below first bract; flowers 2–4 to each cincinnus. *Flowering bracts* 2·5–3·5 cm. long. *Calyx and corolla* buff (or corolla-lobes sometimes tinged with red ?), lip deeper. *Anther-crest* fairly large, exact shape not certain. *Fruit red,* glabrous, ellipsoid, to 2·5 cm. long and little over half as wide.

This species is near *G. densiflora,* but appears to differ in the longer peduncles and rachis of the inflorescence, more widely-spaced cincinni and glabrous rachis. The specimens all have short primary bracts except Ridley's from Maxwell's Hill, in which they are up to 8 mm. long. Ridley says of this specimen that the connective is scarcely prolonged beyond the anther. The flowers are not well enough preserved to show the character clearly. There is certainly a well-developed crest in one specimen of the type collection. If further specimens from Maxwell's Hill show long bracts and crestless anther, Ridley's specimen probably represents a distinct species. On the other hand, further collections may also show intermediates between the type collection and *G. densiflora* in the density of flowering branches.

SPECIMENS. *Perak.* Larut, 3,000–4,000 feet, King's Collector 6310 (type collection). Maxwell's Hill, Ridley 5189. Larut Hills, 4,000 feet, Anderson 60.

12. **Geostachys densiflora** Ridl., J.S.B.R.A.S. 82: 201. 1920. Flora 4: 276. **Fig. 30.**

Rhizome raised on stilt-roots 5–20 cm. above ground, bearing leafy shoots close together, the whole plant forming a close tuft of stems 1 metre wide. *Leafy shoots* to about 120 cm. (to 200 cm. ?) tall; basal sheathing portion green, the old basal sheaths brown. *Leaves* purple beneath for a long time, eventually green, with wavy edges; blade to about 50 by 4·5 cm., glabrous, apex gradually narrowed and more or less caudate (cauda to 2·5 cm.), base cuneate; petiole slender, to 3·5 cm. long; ligule to 1·5 cm. long, glabrous or fringed with short hairs, not lobed. *Peduncles* many, arising

from base of leaf-shoots, basal ¾ erect, then curving downwards, c. 6–12 cm. long, covered with large overlapping sheaths (to 10 cm. long); *rachis* of inflorescence red, 7–15 cm. long, curved obliquely downwards, bearing up to 30 short cincinni which all curve upwards; main and branch-rachises covered with rather stiff spreading hairs barely 1 mm. long. *Bracts* at base of cincinni 3–4 mm. long, rounded, glabrous, the basal ones to 5 mm., narrowed to the tip. *Stalks of cincinni* about 1–2·0 cm. long to the first floral bract, each bearing 2–5 flowers. *Outer floral bracts* 2 to 4 cm. long, glabrous except for a small tuft of hairs on the subapical tooth, or sometimes with scattered short hairs, split about half-way down one side, the apex acuminate and slightly keeled, with a subapical tooth 1·5 mm. long. *Pedicel* up to 6 mm. long, pedicel and ovary glabrous. *Calyx* with ovary about 2 cm. long, transparent whitish, the apex drawn out to a slender tip 5 mm. long on one side, not evidently lobed, glabrous; the tip terminating a flower-bud. *Corolla-tube* as long as calyx without its tip; *lobes* pale translucent yellow, (sometimes pink ?), c. 1·4–1·8 cm. long, dorsal 8 mm. wide with strongly concave tip, laterals 6 mm. wide, spreading. *Lip* 2·5–3 cm. long, 3-lobed; lateral lobes erect, triangular, their tips about 1 cm. from base of lip, midlobe spreading and reflexed at the tip, almost circular, with crinkled edges, about 2 cm. across, minutely hairy on upper surface, pale orange buff, deeper down the midline, with colourless transparent veins. *Staminodes* nil. *Filament* about 5 mm. long and 2 mm. wide, pale yellow buff. *Anther* bent forwards at nearly a right angle to filament and more deeply coloured, 7 mm. long, the crest 3-lobed, total width 8 mm., side-lobes spreading, acute, c. 2 by 1 mm., the midlobe erect, broadly rounded, c. 3·5 mm. wide and 3 mm. long. *Stigma* small, with a narrow transversely elongated mouth fringed with hairs. *Stylodes* 2·5 mm. tall, fleshy, blunt. *Fruit* ellipsoid, glabrous, more or less finely ribbed, about 2 cm. long, red when ripe, stalked like the flower or the stalk elongated further.

SPECIMENS. *Pahang.* Cameron Highlands 5,000 feet, S.F.N. 31205 (Holttum); Batten-Pooll, s.n. November 1939. Fraser's Hill 4,000 feet, S.F.N. 8636 (Burkill and Holttum), 33154 (Corner). *Perak.* Scortechini 381. G. Kerbau 4,000 feet, Robinson (not in H.S., Type).

The above description is based chiefly on field notes and specimens preserved dry and in alcohol by Corner (S.F.N. 33154). Burkill's field notes agree. The Cameron Highlands specimens are not so complete as those from Fraser's Hill. Holttum's 31205 was fruiting only; Batten-Pooll's is a dried specimen showing floral details well (no colour recorded) but there is no complete inflorescence. The Fraser's Hill specimens have floral bracts little over 3 cm. long, lip about 2·5 cm. long and corolla-lobes about 1·4 cm. long. Batten-Pooll's specimen has floral bracts to 4·2 cm. long, lip certainly 3 cm. long and corolla-lobes almost 2 cm. long. It may be that Cameron Highland plants represent a distinct variety; a difference of flower-colour as well as size is possible. Cameron Highlands specimens collected in 1946 had anther-crest 15 mm. wide, its midlobe 7·5 mm. wide and 4·5 mm. high, also filament 9 mm. long.

I have ranked these specimens as *G. densiflora* Ridl., but it is possible they are not truly referable to that species. The type of *G. densiflora* is a specimen of Robinson's from G. Kerbau, presumably at Kew; the collection is not represented in the Singapore herbarium. Ridley's descriptions of other species in this genus indicate that no reliance whatever can be placed on his dimensions of inflorescence, flowers and their parts. All that is clear from his description of *G. densiflora* is that the species is not very large, has narrow leaves, a fairly large and dense-flowered inflorescence with hairy rachis, and the anther-crest large (he says "anther-crest large, round", but the lateral lobes might be broken in a dried specimen). The Fraser's Hill and Cameron Highlands specimens agree in these characters; the Fraser's Hill specimens differ in having corolla-lobes pale yellow, not pink as recorded for *G. densiflora.* It seems best to refer our specimens to Ridley's species at present, pending examination of the type.

13. ELETTARIA Maton

Rhizome stout or fairly stout, the intervals between leaf-shoots often short. *Leaf-shoots* tall, with many blade-bearing leaves; petioles short. *Inflorescences* from rhizome close to the base of a leaf-shoot, long and slender, prostrate, either just at the surface of the ground or just below it (not bearing roots), protected by alternate fairly large scale-leaves, in the axils of which cincinni arise, their attachment being sometimes supra-axillary. *Cincinni* short, bearing a close succession of tubular bracts, each of which encloses entirely the next flower and also the next bract; the flowers in two close rows on one side of the composite axis of the shoot, all pointing in the same direction, and curved, opening in succession. *Calyx* tubular, split about ¼ of its length down one side, shortly 3-toothed; in some species joined at the base to the corolla-tube for a variable distance above the ovary. *Corolla-tube* about as long as calyx; lobes not very broad, subequal, the upper with a concave apex. *Labellum* as in Amomum, with yellow median band and red stripes, sometimes so curved that it stands as a hood over the top of the flower. *Staminodes* none, or short and narrow. *Filament* of anther very short, broad. *Anther* longer than filament, the connective produced at the apex into a small crest. *Stigma* small, in close contact with the distal end of the pollen-sacs. *Fruit* globose or ellipsoid, thin-walled, smooth or with longitudinal ridges when ripe.

This genus has hitherto been regarded as comprising only the two species *E. cardamomum* and *E. major*, from southern India and Ceylon. It agrees in all essential flower-characters with Amomum (in which Gagnepain includes *E. cardamomum*), but differs strikingly in the form of the inflorescence, which (as Bentham pointed out when describing Cyphostigma, in Hook. Ic. Pl. t. 1380) is the most satisfactory basis for generic distinctions in this group of plants. In investigating the Malayan *Elettariopsis longituba* Ridl. I have discovered that this has exactly the same inflorescence-structure as *Elettaria cardamomum;* and the same is true of the Sumatran species *Elettariopsis multiflora* Ridl. It is clear that *Elettariopsis aquatilis* Ridl. (Sumatra) and *Cyphostigma surculosum* K. Schum. (Borneo) have the same structure, and should also be included in the genus; there is also an undescribed Bornean species in the Singapore herbarium.

The essential feature of the inflorescence of Elettaria is a prostrate axis bearing 2-ranked sheaths, with a cincinnus in the axil of each. The structure is thus identical with that of Alpinia and Geostachys, except that the axis is prostrate and the sheaths which correspond to the primary bracts of Alpinia are 2-ranked. If we stretched out the decumbent inflorescence of such a species as *Geostachys decurvata*, and increased the number of the 2-ranked sheaths of its peduncle, putting a cincinnus in the axil of each, we should have Elettaria. If we regard Amomum as a genus in which the lateral cincinni of the inflorescence are each reduced to one flower (which seems the only rational interpretation), then Elettaria cannot be a derivative of Amomum; rather is it another and distinct offshot from the Alpinia stock. But the resemblance of colouring of the flowers in the two genera indicates a near origin in that stock.

Elettaria agrees with Elettariopsis (so far as Malayan plants are concerned) in having long-tubed flowers; but this is probably a superficial resemblance due to the fact that in both *Elettariopsis Curtisii* and *Elettaria longituba* the flowers are produced just below ground-level and must have long tubes to bring them up into the free air. *Elettaria cardamomum*, which has flowers entirely above ground, has short tubes. There is also an important difference between *Elettariopsis Curtisii* and *Elettaria longituba* in the matter of variable flower-length (such variation occurs in both according to the thickness of leaves etc. through which the flowers must penetrate). The lengthening in *Elettariopsis Curtisii* is in calyx or corolla-tube or both; the lengthening in *Elettaria longituba* is in the joined part

of the two tubes, at their base. Such a fusion of the two tubes, forming a separation between ovary and calyx proper, is only known to occur otherwise in *Cyphostigma pulchellum.*

The position of Cyphostigma, which likewise has a prostrate slender inflorescence, is rather different, as in at least three characters it shows a relationship to Elettaria rather than to Elettariopsis. The first has already been mentioned, namely the fusion of calyx and corolla. The second is the tubular bracteoles. The third is the position of the flower, with the lip hooded over the top of it, in which *Elettaria longituba* closely resembles Cyphostigma as illustrated in Hooker's *Icones* (t. 380). It may be that Cyphostigma is a derivative of Elettaria in which the cincinni are reduced to one flower; but the details of branching are not shown with sufficient clearness to make a definite statement, and I have seen no specimens.

Elettaria occurs in Ceylon and southern India, Sumatra, Malaya and Borneo. There is no record of any Burma species; but it is probable that much more remains to be discovered about Zingiberaceae in Burma. It is however perhaps possible that *Elettaria cardamomum* and the Malaysian Elettarias represent parallel developments from different points of origin in the Alpinia stock.

The only known Peninsula species is *Elettaria longituba.* Corner has made some elaborate field notes of this, as found at Kemaman; these are incorporated in the description given below. He records that the flowering runners may be 11 feet (3·3 metres) long, crossing small streams; a similar fact is recorded of *E. aquatilis,* which likewise grows in wet ground (in southern Sumatra) and may be conspecific with *E. longituba. E. longituba* is certainly one of the largest species of the genus, having the vegetative habit of a large Hornstedtia. Its flowers appear singly, at longer intervals than in some other species, few to each cincinnus; and it seems that the cincinnus stops flowering as soon as a fruit is formed. The fruits are large, but apparently not valuable as a spice, like Cardamoms.

Elettaria longituba (Ridl.) Holtt. **comb. nov.** *Elettariopsis longituba* Ridl., Trans. Linn. Soc. 3: 382. 1893. J.S.B. R.A.S. 32: 156. 1899. Flora 4: 275. *Cyphostigma longituba* K. Schum., Pflanzenr. 274. 1904.

Rhizome stout, below ground, bearing leaf-shoots at intervals of 7 cm. or more. *Leaf-shoots* tall (probably to 3 m.), swollen at base to about 6 cm., bladeless basal part greenish to greenish yellow, upper sheaths greenish. *Leaves* rather light green, distinctly but faintly ribbed on the upper side,

midrib yellowish on both sides, blade to 80 by 17 cm., softly short-hairy beneath throughout, apex caudate (cauda to about 3 cm.), base unequal, cuneate; petiole to about 2·5 cm. long, hairy beneath; ligule 5–10 mm. long, short-hairy, broad, somewhat 2-lobed; sheath short-hairy or glabrescent. *Flowering stolons* arising from the under sides of the rhizome and travelling 1–2 cm. below the surface, to 3·5 m. long, when old about 1 cm. thick, white, bearing white or pinkish scale-leaves to 7 cm. long. *Cincinni* arising well above the axils of the scale-leaves, each with a stalk 1 to 3 cm. long, and bearing a succession of a few (5 to 6) flowers opening singly. *Lowest bract* on cincinnus c. 3·2 cm. long, the basal half or more tubular, glabrous. Within this bract is the first flower of the cincinnus (usually abortivé) and another bract. *Second bract* c. 2·5 cm. long, tubular for 2/3 of its length, the apex unequally 2-lobed, each lobe with a short slender tip, glabrous, enclosing a flower and also another bract which in turn encloses a flower and a closed bract. *Flowers* erect, the apical part curved over so that it represents the quadrant of a circle, *with the lip uppermost*. *Calyx* glabrous, with pedicel and ovary to 4 cm. long, split about 1 cm., the teeth rather fleshy, 2–4 mm. long, with narrow tips bearing a few hairs, otherwise glabrous, deep red fading to brown. *Corolla-tube* as long as calyx; lobes c. 1·5 cm. long, dorsal 8 mm., lateral 7 mm. wide, pale pink. Corolla-tube and calyx joined together for nearly 2 cm. above ovary (length of this part varies). *Lip* about 2 cm. long and wide, white with a rather pale yellow median band, which in the proximal third is edged with a fine pink longitudinal stripe and has also 2 pale pink stripes upon it (i.e. 4 stripes in all); edges towards the base inflexed to make a tube, distal part of blade spreading, concave, with reflexed wrinkled edge. *Filament* nil (at most 1 mm.). *Anther* 6 mm. long, crest small, reflexed, almost equally 4-lobed, the lobes quadrangular, each c. 1 mm. long and wide, the whole crest slightly diverging in a fan-shape, total width 4 mm., length 1·5 mm., colour pale pink with white tips. *Staminodes* none. *Stylodes* 3 mm. long, relatively thick and blunt, apex 3-lobed, split to base one side only. *Stigma* small, under 2 mm. wide, immediately in contact with distal ends of pollen-sacs, with forward-turned linear opening. *Fruit* on pedicel 3 mm. long, globose-pyriform, slightly 3-shouldered, smooth and slightly ribbed, with thin walls when dry, surmounted by base of calyx and corolla 3 mm. long, maximum diameter 2·8 cm., height rather less, white when young, brown when ripe.

The flowering stolons do not root. They reach the surface of the ground at times, and sometimes traverse small streams, the flowers appearing out of the water. The details of habit and colour are obtained from Mr. Corner's notes.

SPECIMENS. *Pahang*. Streams and wet spots, Tahan, Ridley 2403 (type). *Perak*. Upper Perak, 300 feet, Wray 3586. *Selangor*. Gunong Hitam, Goodenough s.n. 1897. *Trengganu*. Kemaman, Ulu Kajang swamp, S.F.N. 30484 (Corner).

COSTUS Linnaeus

Stems erect from rhizome; covered near the base with bladeless sheaths, leafy higher up, at first unbranched, later branched, with secondary branches also; branches breaking through leaf-sheaths. *Leaves* spirally arranged on stem (spiral sometimes very steep); base of blade usually attached to sheath by a short stalk and articulated at the junction; sheath tubular, its apex running round across the base of the blade as a short ligule. *Inflorescence* dense, globose or ellipsoid, terminal on leafy stems or on short leafless shoots; bracts in a series of parastichies, usually broad and overlapping at the base, with 1 or 2 flowers (one in Malayan plants); bracteoles smaller, laterally flattened, in the case of one flower facing at right angles to the bract, not tubular at the base. *Calyx* tubular, more or less deeply 3-lobed, lobes often acute or thorn-like, the anterior one usually broader than the other two. *Corolla-tube* shorter or longer than calyx, lobes overlapping. No *staminodes*. *Labellum* large, obovate, thin, the edges often crisped, never deeply lobed, often brightly coloured. *Stamen* with broad petaloid filament which usually curves forwards and closes entrance to tube of flower, with upturned tip; anther well below apex of stamen, little raised from its surface. No erect *nectaries* in base of tube, but two hollows which secrete nectar, being connected below to a gland in the apex of the ovary. *Ovary* trilocular; ovules many, in 2 rows. *Capsule* 3-angled, the lateral angles smaller and more spreading, loculicidal, gaping with 3 slits, not splitting to the apex. *Seeds* angular, usually with white fleshy aril, all those in one loculus adhering together by their arils on dehiscence; embryo straight, in copious endosperm; operculum present.

This is the only genus of Zingiberaceae, as arranged by Schumann, which is pantropic; and it is further remarkable in that the majority of the species are African and American, whereas in the family as a whole the great majority of species are Asiatic. Costus is the main representative of the sub-family Costoideae, the only other important genus being the Papuasian Tapeinochilus.

Schumann was the first to point out the important differences between the Costoideae and Zingiberoideae, namely the spiral arrangement of the leaves, the closed (entirely tubular) leaf-sheaths with circular ligule, the sunken nectar-glands, and the lack of aromatic substances in the plant. Costus itself is also remarkable for the complete absence of staminodes and the very large convoluted lip. Loesener (Pflanzenfam. Ed. 2, 15A: 551) quotes Troll as suggesting that the large lip of Costus represents a

complete union of all five non-functional stamens, and this seems likely to be correct. The very broad petaloid stamen is another characteristic feature of Costus itself. Tapeinochilus differs in floral form, but is very close vegetatively to Costus: this is one of many indications of the importance of vegetative features (and especially those of the inflorescence) in a comparative study of the family.

Ridley considered that Malayan specimens of Costus represented five species; these are here reduced to three, two (*C. Kingii* and *C. velutinus*) being regarded as varieties of *C. globosus*. *C. speciosus* has a very wide distribution in Indo-Malaysia, and is variable; it grows on the edges of forest and in similar half-open places, not in the full forest-shade like *C. globosus*, and this tolerance of exposure has doubtless permitted it to spread. *C. globosus* is distributed throughout western Malaysia. The third species, *C. oligophyllus*, is still only known from the original collection, and has been incompletely described.

The West African species *Costus lucanusianus* was introduced to Singapore as an ornamental plant. It has become well established in the Botanic Gardens, reproducing itself freely from seeds, and has formed dense thickets in half-shaded places, or even in full sun where the soil is fairly good. It is in fact a weed which may become troublesome if not controlled. It has the habit of *C. speciosus* but the labellum has crimson sides and orange centre, with white towards the base only; a vegetative distinction is a raised ring round the top of the leaf-sheath, the ring bearing stiff spreading hairs. Another West African species, apparently *C. Schlechteri*, is also well established in the Botanic Gardens, Singapore, but only in full shade. It has white flowers, usually on a short separate stem close to the ground but occasionally also on the end of a leafy stem; there are two flowers to each bract, a character not seen in native Malayan species.

KEY TO COSTUS IN MALAYA

Inflorescence at apex of leafy shoots

Labellum white and yellow only 1. *C. speciosus.*

Labellum with crimson and orange patches [*C. lucanusianus (African)*].

Inflorescence on short leafless shoots

Bracts and calyx-lobes ending in stout spines, conspicuously hairy or scabrid 2. *C. globosus.*

Hairs on bracts and lobes of calyx club-shaped, about 0·5 mm. long. var. *Ridleyi.*

Hairs on bracts and calyx needle-like, 1–2 mm. long
Leaves and sheaths short velvet-hairy
var. *Kingii*.
Hairs on leaf-sheaths spreading, c. 3 mm. long
var. *velutinus*.

Bracts and calyx-lobes acute but not ending in spines, not conspicuously hairy 3. *C. oligophyllus*.

1. **Costus speciosus** (Koenig) Sm., Trans. Linn. Soc. 1: 249. 1800. Ridl., Flora 4: 256. *Banksia speciosa* Koenig in Retz. Obs. 3: 75. 1783. *Costus nepalensis* Rosc., Monandr. Pl. t. 80. 1828. **Fig. 31, 32.**

Stem 2–3 m. or more tall, much branching when old; base of stem covered with sheaths only for 60 cm. or more, rest leafy. *Leaves: sheath* c. 4 cm. long, green ± flushed with purple, with many closely pressed fine short hairs, top edge of sheath with rather long fine soft hairs (not spreading) to 7 mm. long; *petiole* 5–7 mm. long, short appressed-hairy above and below; *blade* to c. 23 by 6 cm., oblanceolate-acuminate, widest 1/3 from apex or sometimes in middle, base narrowly rounded; dark green and glabrous or appressed-hairy above, with paler grooved midrib, finely appressed-hairy below, paler (hairs pale greenish). *Inflorescence* to c. 5 cm. diameter and 10 cm. long, on short stalk usually curved, close to uppermost leaf. *Bracts* c. 1·4 cm. long, ovate acute, green ± flushed with red, with a narrow red fleshy protuberance up to 5 mm. long below the apex; densely minutely hairy with distinctly ciliate edges (hairs vary in length) or rarely glabrous. *Bracteole* one to each flower, c. 1 cm. long, keeled, acute, ± tinged with red especially at the ciliate edges. *Flower* 1 to each bract. *Calyx* at flowering much longer than bract, with the ovary c. 2·2 cm. long (calyx alone c. 1·3 cm.); 2 posterior teeth 3 mm. long, strongly keeled; anterior tooth nearly 5 mm. long, not keeled; teeth all more or less red, hairy like the bracts or rarely glabrous, tube of calyx green, reddening after flowering. *Ovary* at flowering much flattened, c. 9 mm. wide. *Corolla-tube* shorter than calyx; lobes 3–5 cm. long, faintly pinkish (pink in bud). *Labellum* curved, trumpet-shaped, the edges overlapping, tip to apex of ovary c. 5·5–7·5 cm., white with cream median band hardly reaching apex, with yellow hairs in this band at throat of trumpet, longest hairs 1 cm. from base of tube. *Stamen:* free part 2·5 cm. long when flattened, 1·2 cm. wide, yellow at apex only, hairy on back. *Fruit* bright red, dehiscing loculicidally: seeds black with fleshy white arils all coming out in one group.

This species is very widely distributed in Indo-Malaysia, and very common in Malaya, chiefly on the edges of forest.

Herbarium specimens all have leaves hairy below, but the amount of hairiness varies much. Some specimens (including some from Singapore) have leaves hairy above. A few plants have much longer hairs than the rest, those on sheaths spreading a little. One collection from Perak has

inflorescence on leafless stem 12 cm. long, covered with short overlapping softly hairy sheaths.

It is impossible to tell the size of flowers from herbarium specimens. The typical form is said to have large flowers 10 cm. long, but I have not seen a Malayan specimen of this size.

var. sericea (Bl.) Schumann, Engl. Bot. Jahrb. 27: 343. 1899. *C. sericeus* Bl., Enum. Pl. Jav. 1: 62. 1827.

This is said to be more hairy, with flowers 5–6 cm. long. But hairiness varies much and can hardly be used to separate varieties clearly.

A plant flowering in the Botanic Gardens, Singapore, has leaves glabrous above, bracts and calyx quite glabrous, and lip 7·5 cm. long and 7·5 cm. wide in its natural position. But it is certain that some large-flowered plants have hairy calyx and bracts. The only specimen with glabrous bracts and calyx is from Bukit Mandai, Singapore Island.

2. **Costus globosus** Bl., Enum. Pl. Jav. 62. 1827 (sens. lat.). Valet., Ic. Bog. 2: t. 163. 1905.

Stems to 3 m. or more tall, much thickened at base, covered with sheaths only for greater part of height, leafy towards apex, leaves in a steep spiral; erect when young, when older often bent over and branching much; erect stems branching near apex only. *Leaves* (on main stem): blade to about 30 by 10 cm., widest 1/3 from apex and narrowed evenly to slightly unequally cuneate base, apex abruptly shortly acuminate, tip c. 2 cm. long, glabrous or hairy beneath; stalk to 5 mm. long and wide; sheath glabrous or hairy. *Inflorescence* from rhizome: peduncle usually 2–10 cm. long, exceptionally to 20 cm., covered with overlapping sheaths 2–4 cm. long, hairy as bracts; spike globose or slightly elongate, 5–9 cm. diameter: one bracteole and one flower to each bract. *Bracts* 2 to 3·5 cm. long, to 2·5 cm. wide, apex broadly rounded with a stout acute spine-like tip which projects 2–3 mm. and is produced downwards as a thickening on the back; outer surface more or less densely hairy, the hairs stiff and needle-like or short, broad and blunt; colour of bracts red, spiny tips yellowish. *Bracteole* nearly as long as bract, but much narrower, similarly pointed, or sometimes passing right across the back of the calyx and almost completely embracing the base of the ovary. *Calyx* at flowering 2·5–4 cm. long including the ovary, hairy like the bracts, lobes to 8 mm. long, all three ending in stout spines like the bracts, red. *Corolla-tube* shorter than the calyx: lobes about 3·5 by 2 cm., hairy on back (in Peninsular plants), apiculate (apiculus longer on dorsal lobe) pink to deep red. *Lip* cherry red to bright orange yellow, always orange in the throat, edges with rather long hairs, inside towards throat short yellow hairs. *Stamen* same colour as lip or paler, with long white or yellow hairs on back. *Ovary* hairy, hairs always slender and appressed. *Fruit* enclosed by bracts. *Rarely an epiphyte:* usually in moist forest near streams, often very large.

var. **Ridleyi.** (Schum.) Holtt., **stat. nov.** *Costus Ridleyi* K. Schum., Pflanzenr. Zingib. 411. 1904. *Costus globosus* quoad Ridl., J.S.B.R.A.S. 32: 125. Flora 4: 256. **Fig. 33.**

Bracts and lobes of calyx bearing swollen club-shaped unicellular hairs c. 0·5 mm. long, basal part of calyx with short thin hairs; bracts usually not over 2·5 cm. long; bracteoles usually embracing whole base of ovary. *Leaves* almost glabrous beneath. *Corolla-tube* hairy. *Flowers* red.

Throughout Malaya in moist lowland forest but not north of Perak.

SPECIMENS. *Perak.* Maxwell's Hill, Ridley s.n. June 1893 (large bracts). Waterloo Estate, 1,500 feet, Curtis s.n. May 1890. Tanjong Rambutan, S.F.N. 23772 (Henderson). *Selangor.* Gua Batu, Ridley 8474. Dusun Tua, Ridley s.n. May 1896. Pataling, Ridley s.n. 27.6.1889. Klang Gates, Hume 7280 (F.M.S. Mus.). *Negri Sembilan.* Perhentian Tinggi, s.n. 1898. G. Tampin 2,000 feet, S.F.N. 3102 (Burkill). Ulu Bendul, S.F.N. 9848 (Holttum). Bukit Tampin, Goodenough 1908. *Pahang.* Tahan River, Ridley 2392. Ulu Chineras, K. Lipis, S.F.N. 15684 (Burkill and Haniff). P. Tioman, Joara Bay, S.F.N. 1147 (Burkill). Tembeling, S.F.N. 21778 (Henderson). *Johore.* Ulu Madik, S.F.N. 10639 (Holttum). G. Panti, Ridley s.n. December 1899. *Singapore.* Bukit Timah, Ridley s.n. 1892; S.F.N. 126 (Burkill).

var. **Kingii** (Bak.) Holtt., **stat. nov.** *Costus Kingii* Bak., F.B.I. 6: 250. 1892. Ridl., J.S.B.R.A.S. 32: 125. 1899. Flora 4: 257.

Bracts and calyx bearing slender pale needle-like hairs of 3–4 cells, 1–2 mm. long, bracts usually 3 cm. or more long, bracteoles narrow. *Leaves* hairy beneath throughout, the hairs on the midrib always distinct, close, spreading, on the lamina close, erect, velvety to the touch, sometimes very short: leaf-sheaths also short-hairy. *Flower* bright orange. Lowlands, many localities, not south of Tampin: occurs in Penang.

SPECIMENS. *Perak.* Ulu Temango, Ridley s.n. 1909. *Penang.* Pulo Boetong, Curtis 1976. Balik Pulau, Ridley s.n. 1898. Highlands Reserved Forest, S.F.N. 1475 (Burkill). *Pahang.* Bentong, S.F.N. 14104 (Best). Sungei Tahan; Ridley s.n. 1891. *Selangor.* Ulu Gombak, 1,000 feet, S.F.N. 34207 (Md. Nur).

var. **velutinus** (Ridl.) Holtt., **stat. nov.** *Costus velutinus* Ridl., J.S.B.R.A.S. 57: 103. 1910. Flora 4: 257.

Bracts and calyx hairy as in var. *Kingii* but hairs denser and thicker. *Sheaths* of peduncle similarly hairy. *Flowers* orange-red. *Leaves* hairy as in var. *Kingii* but the hairs longer; hairs on leaf-sheaths copious, spreading, c. 3 mm. long. Perak only near Grik and at Temengoh.

SPECIMENS. *Perak.* Ulu Temengoh, Ridley (Type). Grik, S.F.N. 12473 (Burkill and Haniff).

Three species of Ridley's Flora are here united, namely his *C. globosus*, *C. Kingii* and *C. velutinus*. They are all very closely allied, and none of them agree exactly with

C. globosus Bl. of Java. As far as can be judged from herbarium specimens, the distinctions are mainly of hairiness only, of the leaves and inflorescence, and thus it seems preferable to regard them all as varieties of one species. There may well be differences of vegetative habit (size, mode of branching etc.) but these have not been established. If they should prove to exist, it may be well to revert to a separation of the three as separate species.

Some specimens referred to var. *Ridleyi* on grounds of the swollen short hairs of the calyx and bracts disagree with most others of the variety in having long bracts (3·5 cm. long) and narrow bracteoles on one side of the calyx only, exactly as in var. *Kingii*. Some specimens of var. *Kingii* also have short bracts as in most specimens of var. *Ridleyi*, but their bracteoles are narrow. Thus the distinctions between these varieties do not seem very sharp. The information as regards flower colour does not appear to be uniform within a variety as at present recognized. More information on this is needed, especially from places (like Tahan River) where two varieties grow near together.

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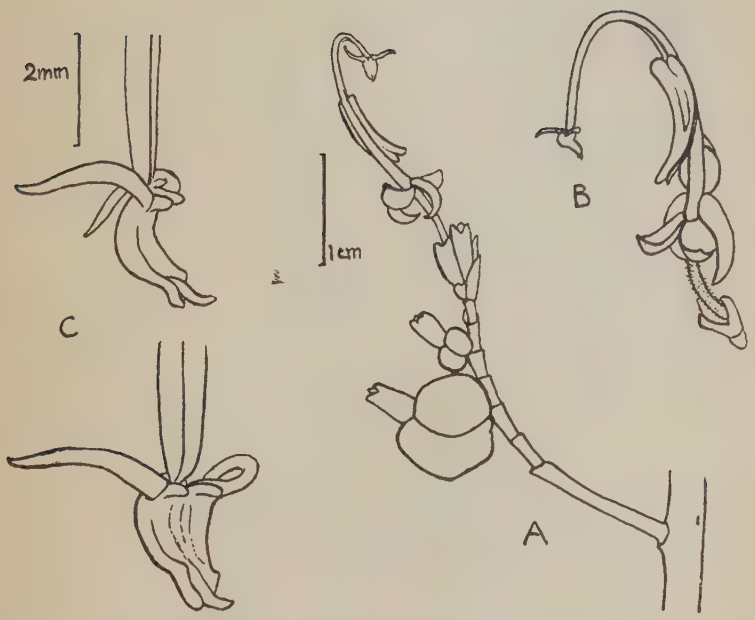

Fig. 1. *Globba leucantha.* A, single cincinnus with two developing fruits, a flower, and buds. B, a complete flower. C, two views of anther and stigma.

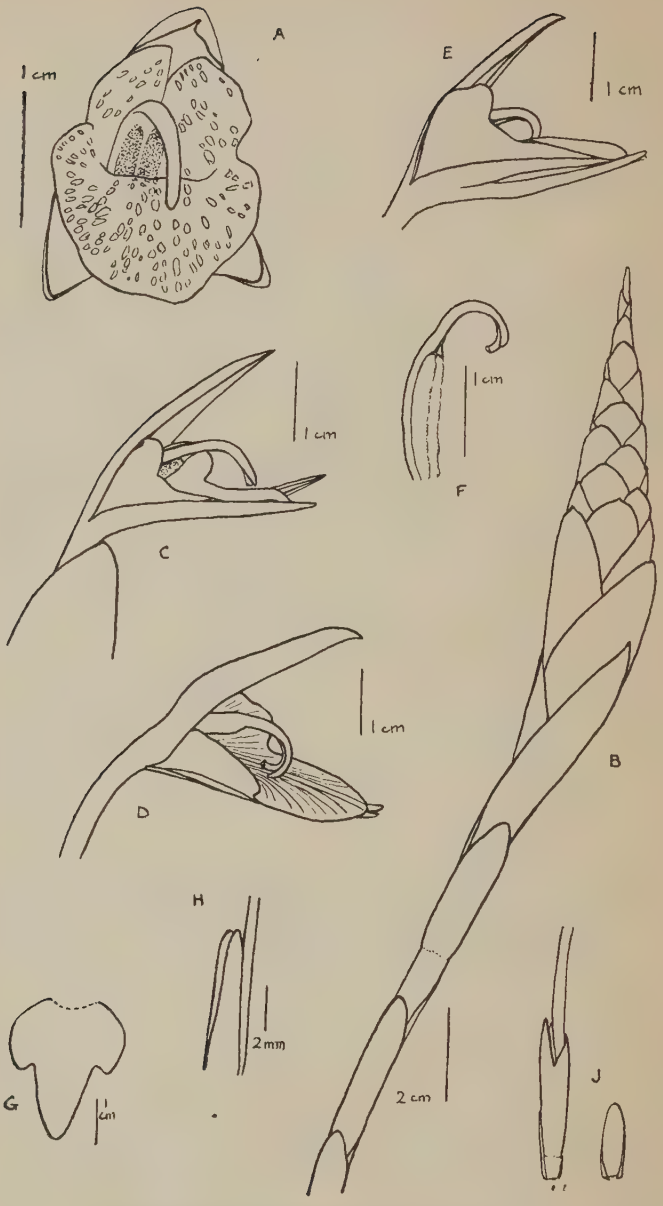

Fig. 2. A, *Zingiber multibracteatum*, single flower. B–J, *Z. puberulum*. B, inflorescence. C, flower just opened, in morning, with top of bract. D, flower in afternoon. E, flower from below, showing junction of lip and lateral lobes of corolla. F, anther. G, lip flattened. H, stylodes. J, base of flower (bracteole is behind) and bracteole.

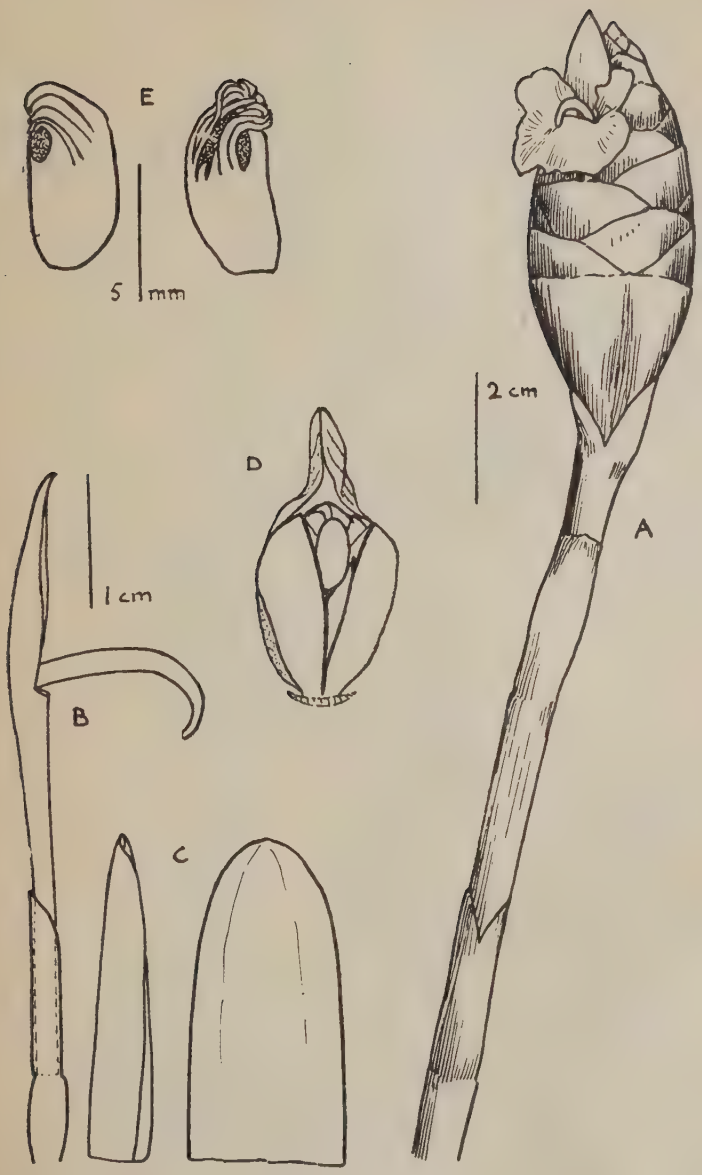

Fig. 3. *Zingiber zerumbet*. A, rather young inflorescence with flower. B, flower with lip and two corolla-lobes removed. C, bracteole in natural position and flattened. D, dehiscing fruit enclosed by bracteole. E, seeds covered with aril.

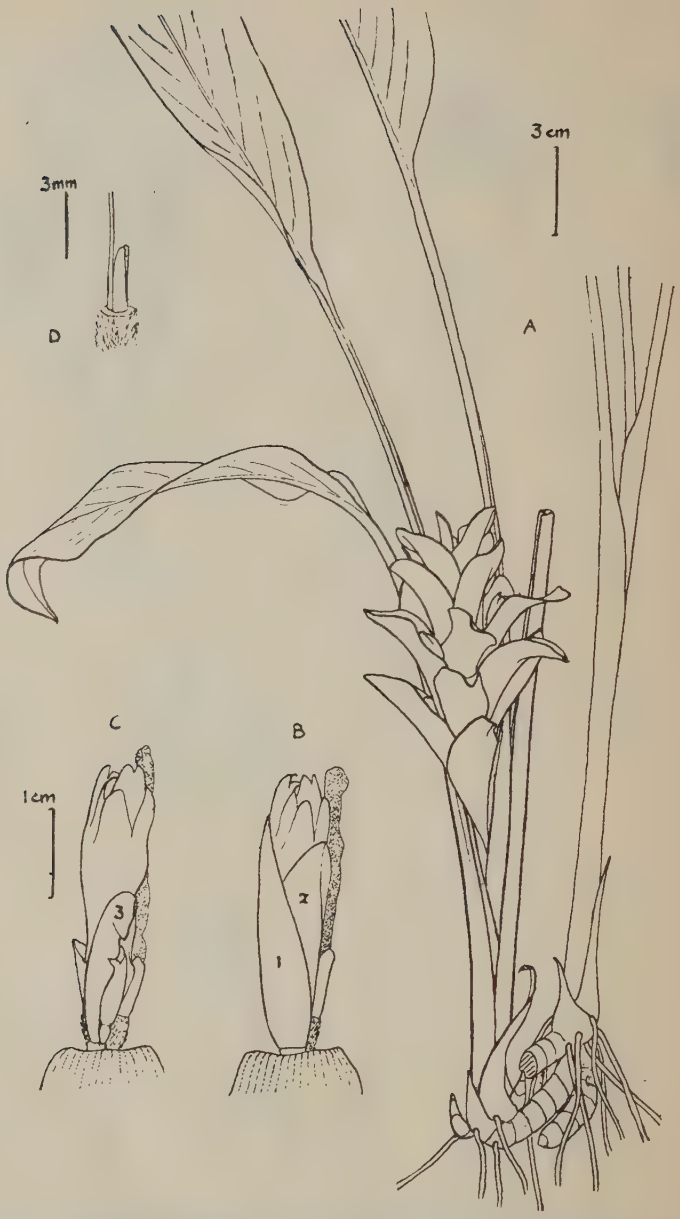

Fig. 4. *Curcuma domestica.* A, part of plant with inflorescence. B, one cincinnus, as exposed by pulling down primary bract; 1, 2, first and second secondary bracts enclosing next flower-bud; on right, dead first flower. C, same cincinnus with first and second secondary bracts removed, showing third secondary bract (3). D, stylodes and base of style.

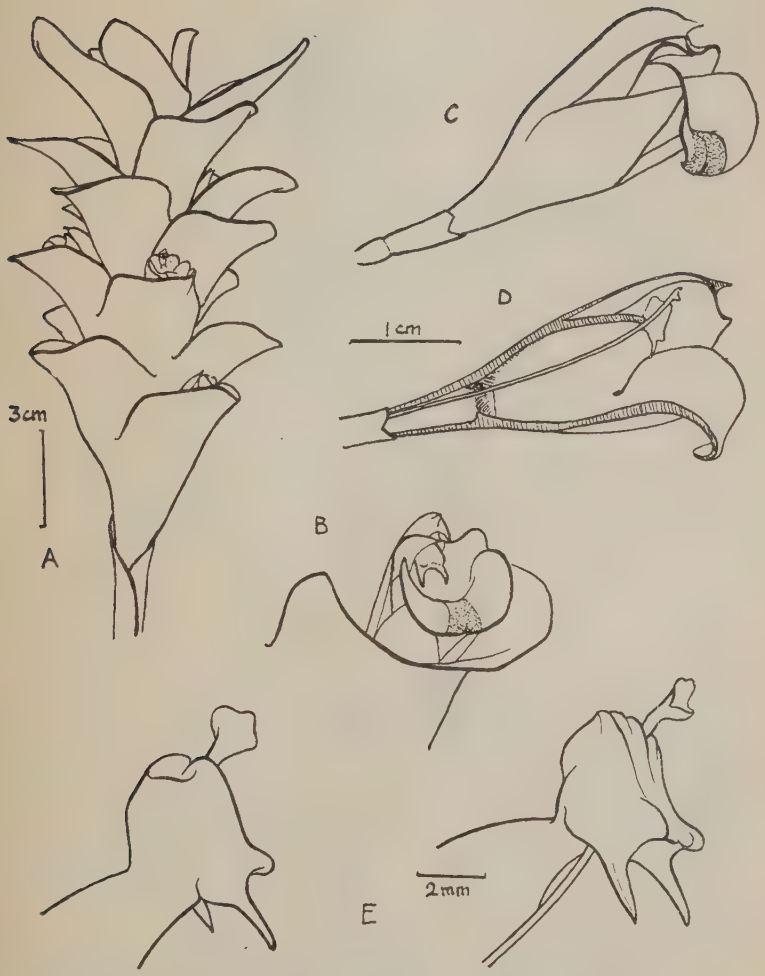

Fig. 5. *Curcuma zeodaria.* A, inflorescence. B, end of primary bract and a flower. C, a single flower. D, longitudinal section through upper part of flower. E, two views of stamen, style and stigma.

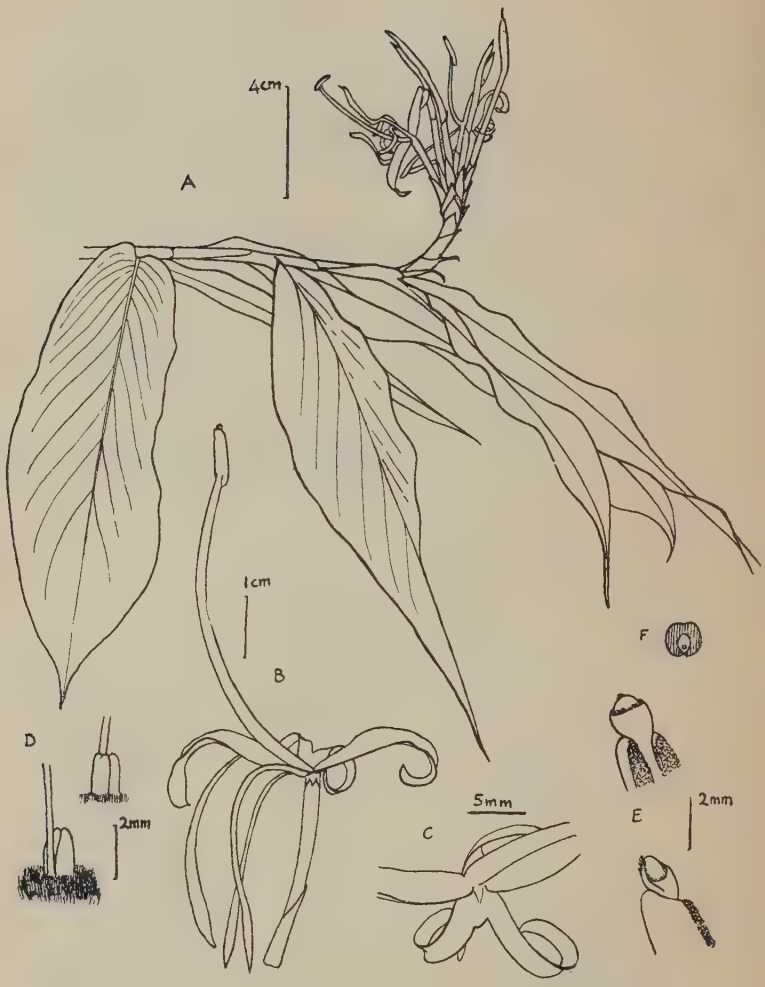

Fig. 6. *Hedychium longicornutum.* A, end of flowering stem in natural position. B, flower, with bracteole; the 3 corolla-lobes pendulous on the left, staminodes to left and right, lip at back. C, lip, bases of staminodes and of stamen, with dorsal corolla-lobe at back. D, two views of stylodes. E, two views of stigma and top of anther. F, transverse section through filament and style.

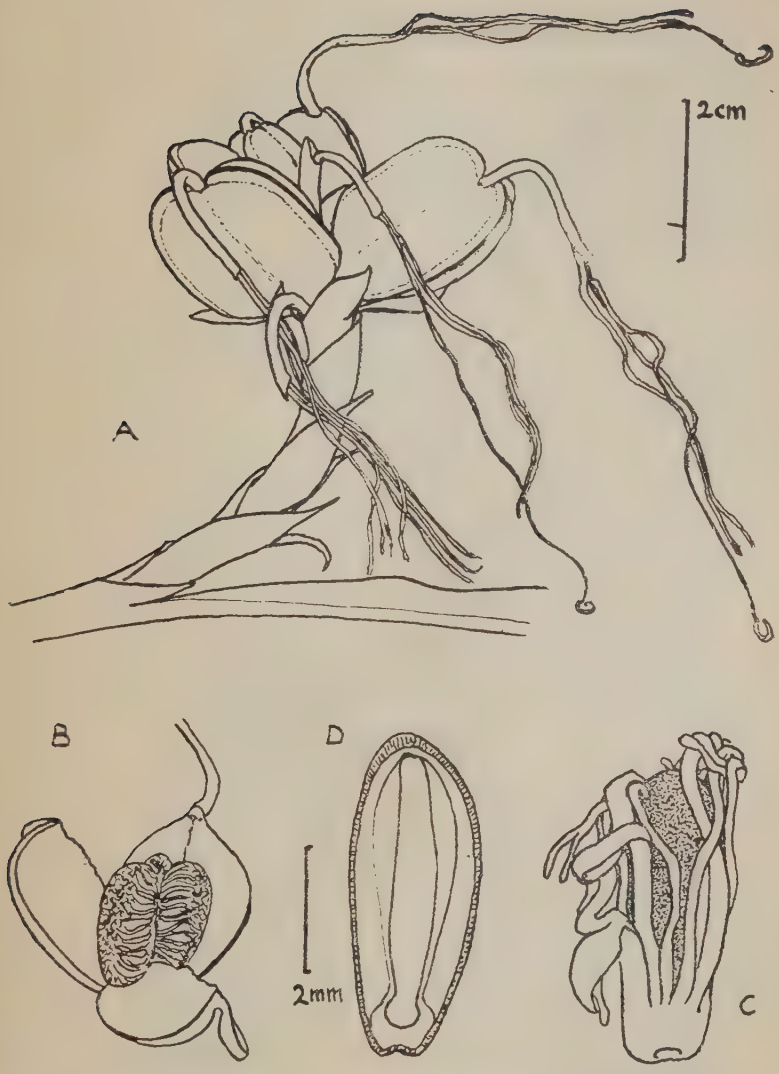

Fig. 7. *Hedychium longicornutum.* A, fruiting inflorescence. B, dehisced fruit with mass of seeds intact. C, one seed with its aril. D, section of seed, showing embryo, endosperm and perisperm.

Fig. 8. *Camptandra latifolia.* A, a single shoot with leaves and inflorescence. B, stamen, style and stigma. C, lip and stamen; staminodes and dorsal petal removed.

Fig. 9. *Scaphochlamys Kunstleri.* A, single leafy shoot with inflorescence. B, flower, excluding calyx. C, base of flower. D, longitudinal section through top of flower, the stamen intact. E, anther with stigma. F, back of top of anther. G, section of ovary showing ovules on a basal placenta and incomplete septa.

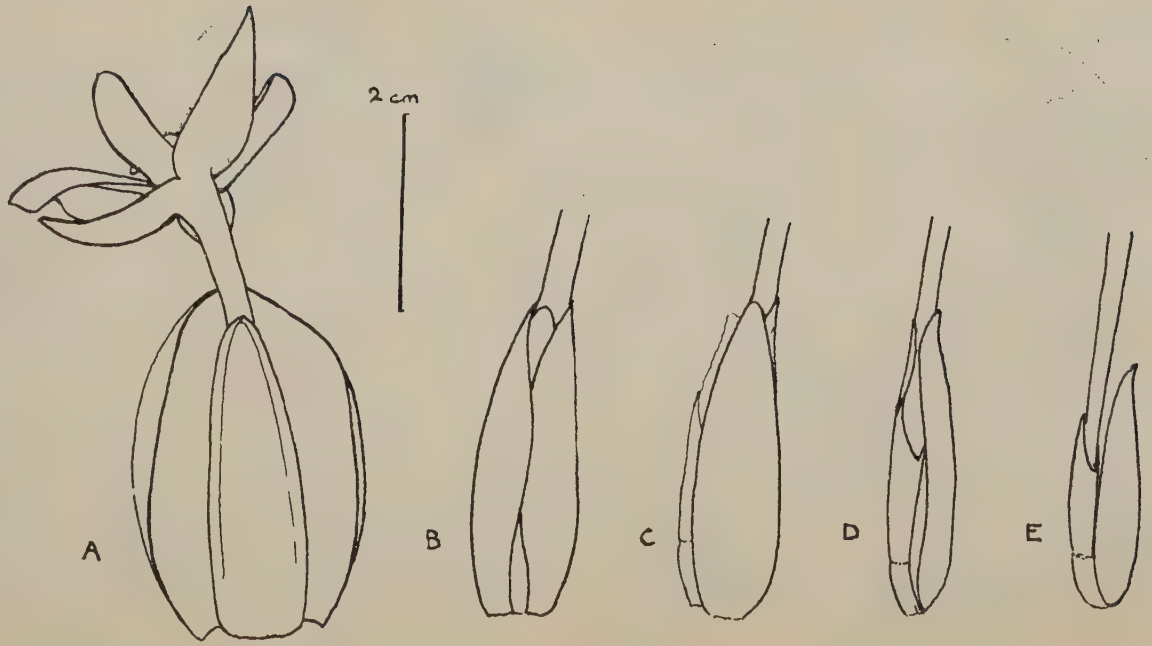

Fig. 10. *Scaphochlamys Kunstleri.* A, inside of bract, with third flower open and rest of cincinnus covered by the first secondary bract. B, same from side facing the primary bract. C, as B, but first secondary bract removed; on left is remains of second flower, on right base of third flower. D, as B, with second secondary bract and remains of second flower removed. E, as D, with third secondary bract removed.

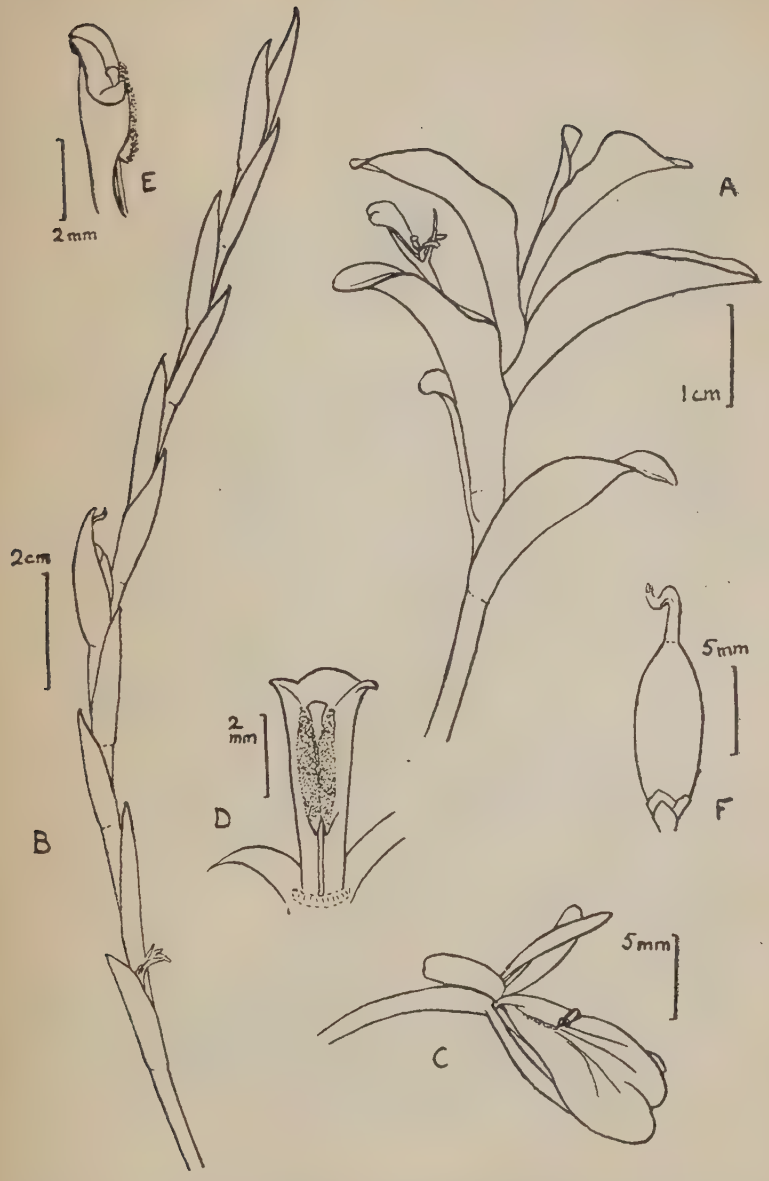

Fig. 11. A, *Scaphochlamys rubromaculata*, inflorescence with one open flower. B–F, *S. tenuis*. B, inflorescence; the fifth bract from the base has a fruit in its axil. C, a flower. D, stamen and base of staminodes. E, anther, lateral view. F, fully developed fruit, containing one seed.

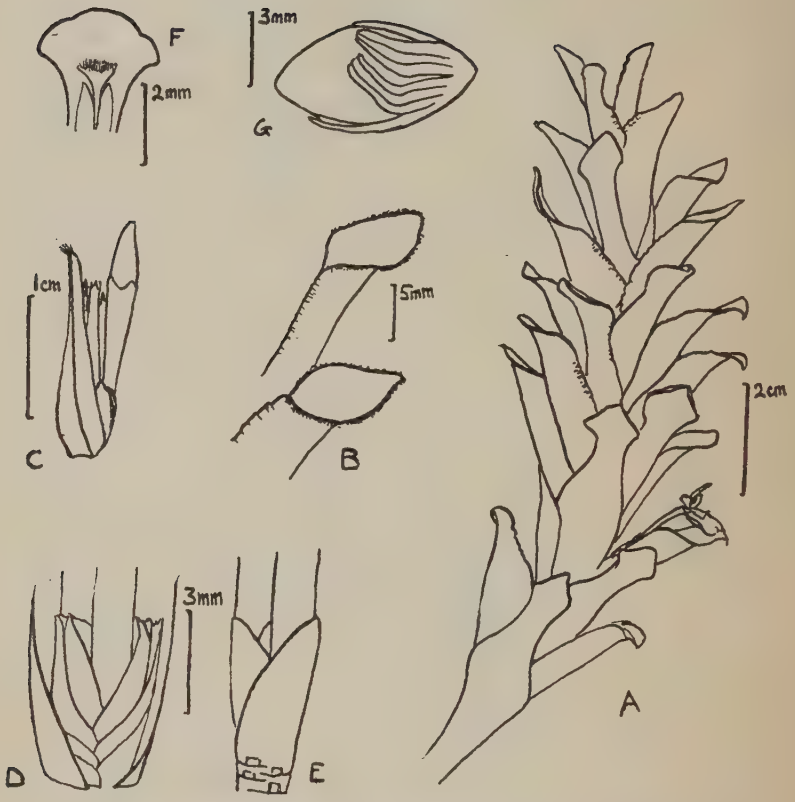

Fig. 12. *Scaphochlamys erecta.* A, inflorescence. B, tips of two bracts. C, one cincinnus, showing first secondary bract on left, some shrivelled flowers and one flower-bud. D, base of cincinnus shown in C, as viewed from right. E, same viewed from left, with outer secondary bract and dead flowers removed. F, anther-crest and stigma. G, seed.

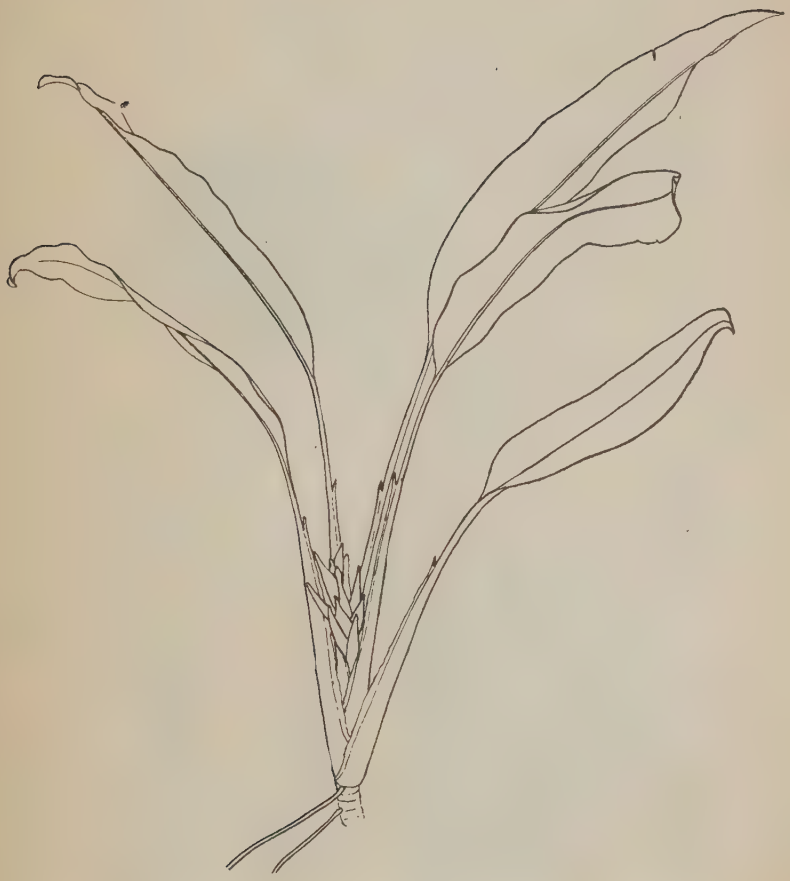

Fig. 13. *Scaphochlamys Klossii*, a small plant with inflorescence; outer sheaths removed.

Fig. 14. *Kaempferia rotunda*, inflorescence with one open flower; on right, a stamen with style and stigma.

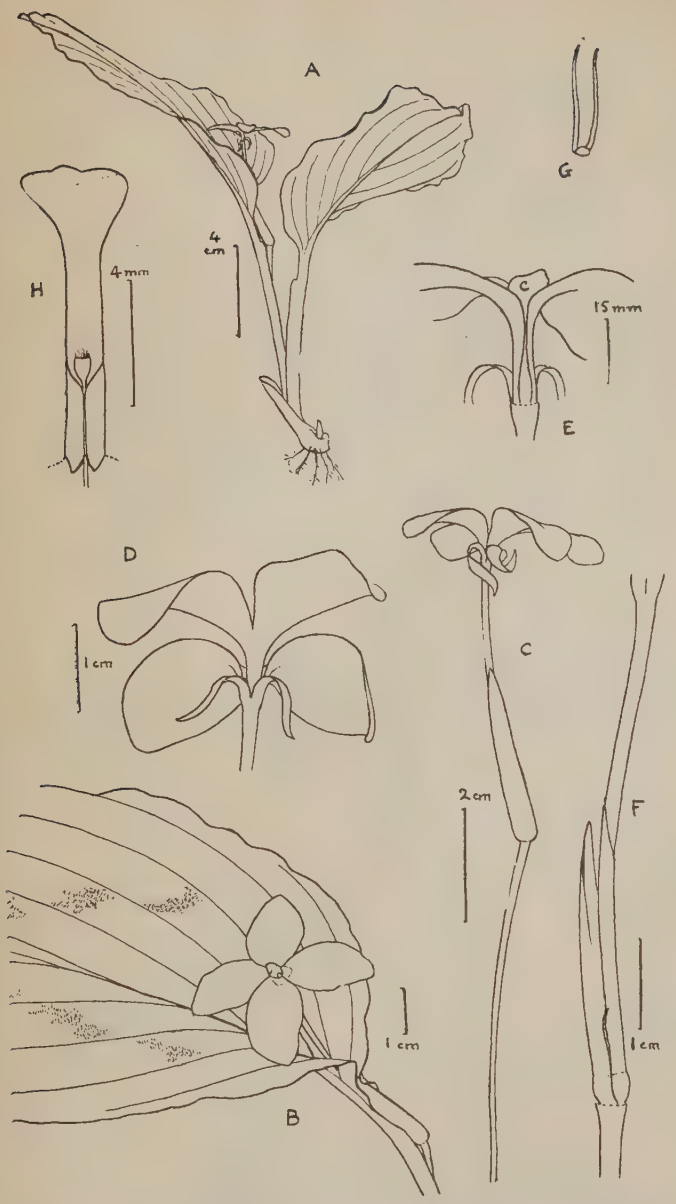

Fig. 15. *Kaempferia pulchra.* A, one leafy shoot with inflorescence. B, inflorescence and base of leaf-blade. C, inflorescence and peduncle, one flower expanded, corolla-lobes in normal position. D, flower from below, showing narrowed base of bilobed lip, 2 corolla-lobes (untwisted) and 2 staminodes. E, flower with staminodes and dorsal corolla-lobe removed, showing base of lip clasping stamen; c, anther-crest. F, inflorescence with 2 outer bracts removed, showing base of a flower with part of bilobed bracteole; on left, bract enclosing next flower. G, bilobed bracteole. H, sessile stamen with its crest (tip of crest turned backwards) and stigma.

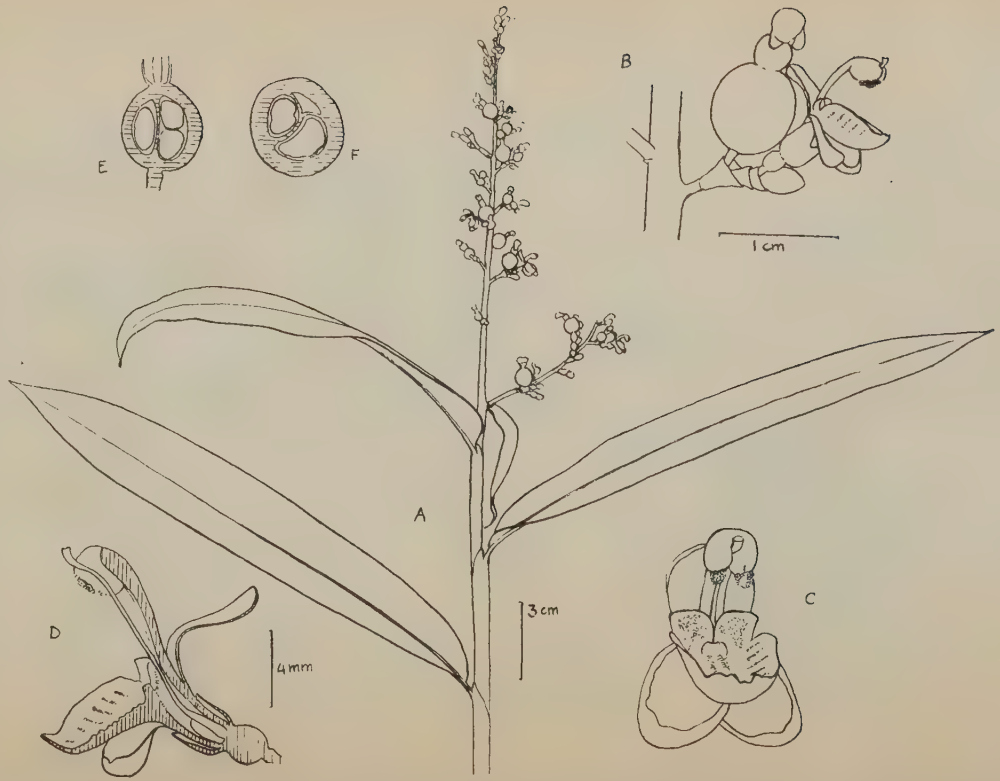

Fig. 16. *Alpinia conchigera.* A, top of flowering stem. B, a cincinnus with fruit developing from first flower, second flower fallen (pedicel at back, not seen) and third flower open. C, front view of flower, showing staminodes. D, section of flower. E, longitudinal section of young fruit. F, transverse section of same.

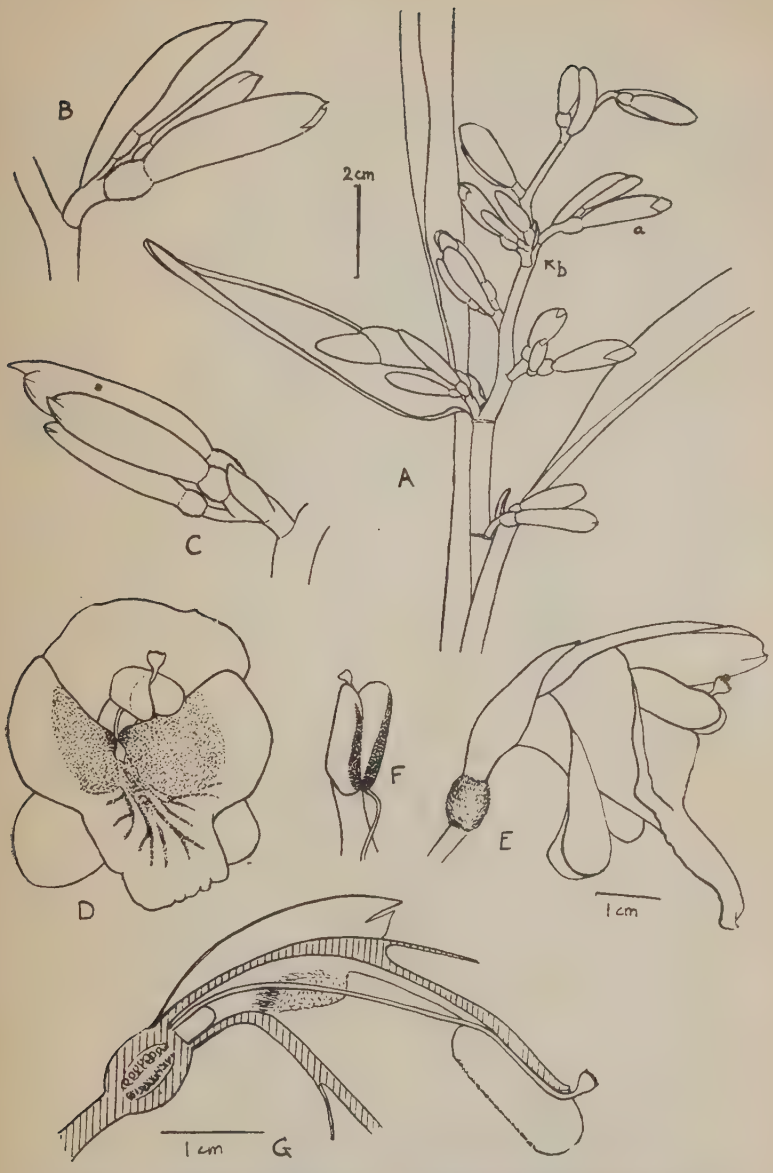

Fig. 17. *Catimbium muticum*. A, inflorescence just expanded, with flowers in bud, the lower left-hand cincinnus in axil of a large sheath. B, cincinnus a enlarged, with large bracteole. C, cincinnus b enlarged, showing 3 flowers in bud and one small bracteole. D, mouth of flower. E, side view of flower. F, stamen and stigma. G, longitudinal section of flower.

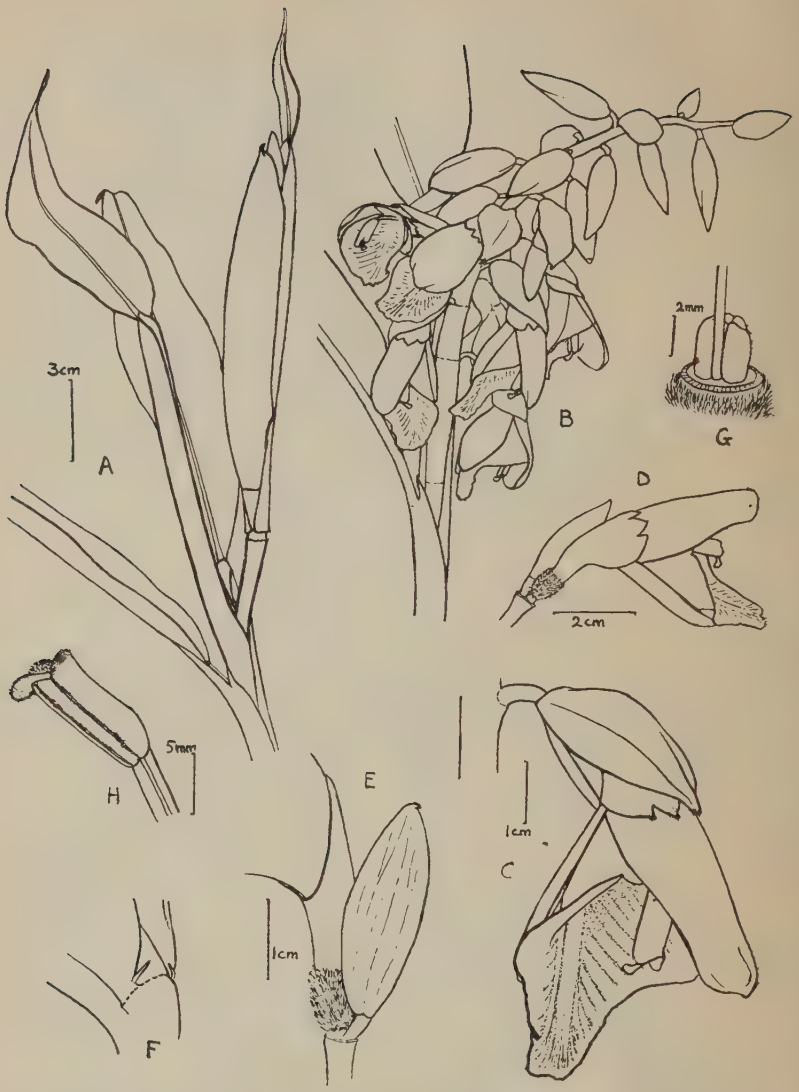

Fig. 18. *Catimbium latilabre*. A, young inflorescence, covered by its two sheaths, just emerging from top of leaf-sheaths. B, inflorescence with basal flowers open, upper enclosed by bracteoles. C, an open flower, calyx covered by bracteole. D, flower with bracteole removed, showing second flower enclosed by second bracteole. E, same enlarged, seen from opposite side. F, base of lip and stamen (dorsal petal removed) showing staminodes. G, stylodes. H, stamen and stigma.

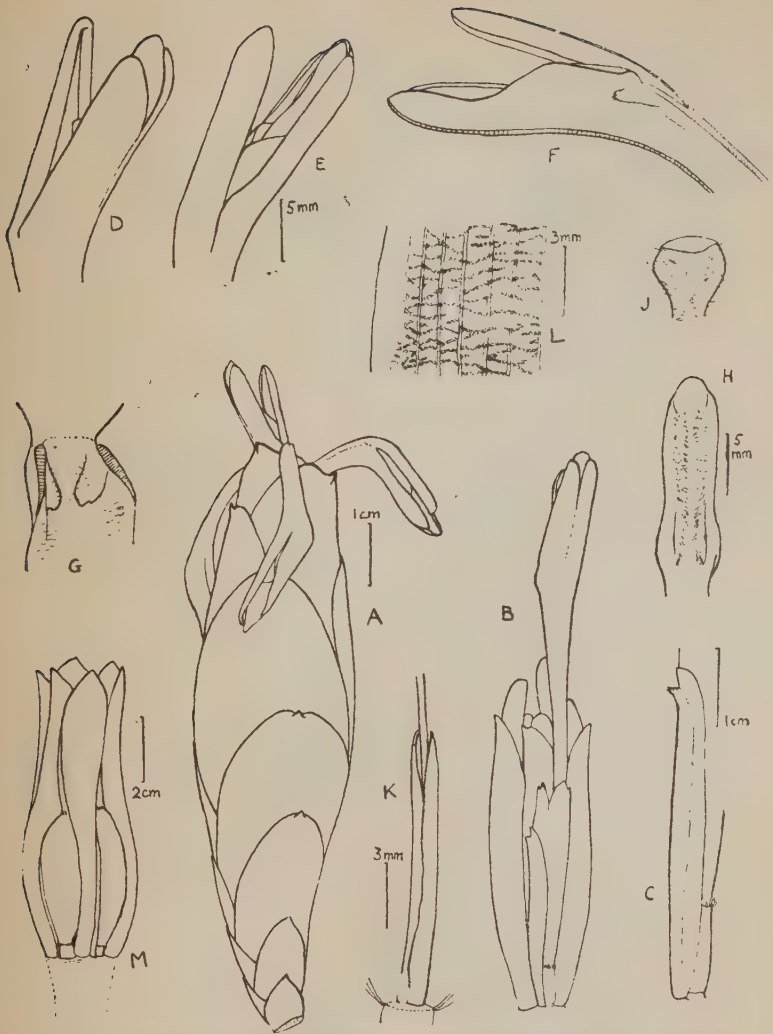

Fig. 19. *Hornstedtia scyphifera.* A, inflorescence, with one open flower and three old ones. B, inner part of inflorescence; a bract removed to show open flower with its bracteole, calyx and corolla; other flowers in bud covered with their bracts. C, bracteole of an outer flower. D, mouth of open flower (lip and 2 corolla-lobes on right). E, another view, showing inner surface of lip. F, longitudinal section through lip and dorsal petal, showing staminode at base of lip. G, base of lip with its auricles removed, showing staminodes. H, anther from below. J, stigma. K, stylodes and base of style. L, part of an involucral bract, showing vertical ribs and white cross-bars. M, inner bracts of an old inflorescence, with fruits.

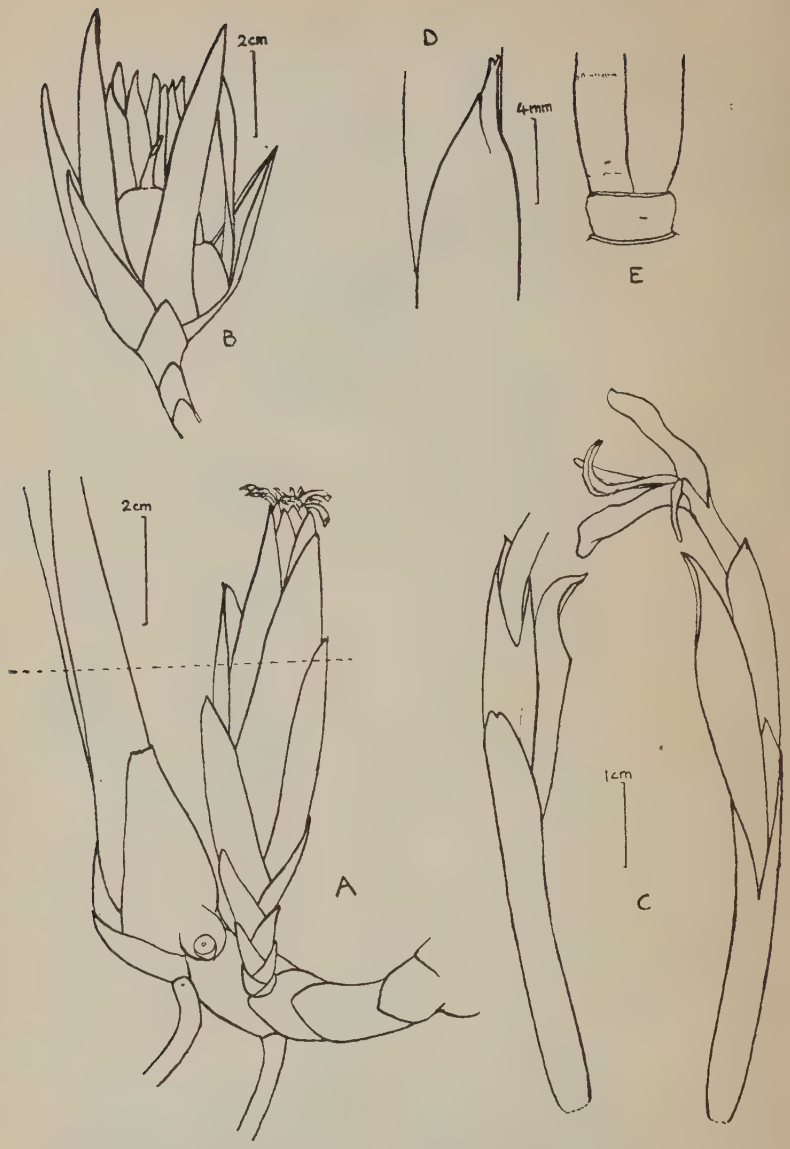

Fig. 20. *Hornstedtia leonurus*. A, base of leaf-shoot and inflorescence; dotted line shows surface of ground. B, an old inflorescence with fruits. C, two views of bracteole enclosing two flowers; the right-hand drawing shows the inner bracteole between the flowers; one flower is represented by shrivelled calyx only. D, apex of inner bracteole. E, common pedicel of two flowers with bracteole-scar at top and bract-scar at base; left-hand flower shows ovary and base of calyx, right-hand flower is covered with inner bracteole.

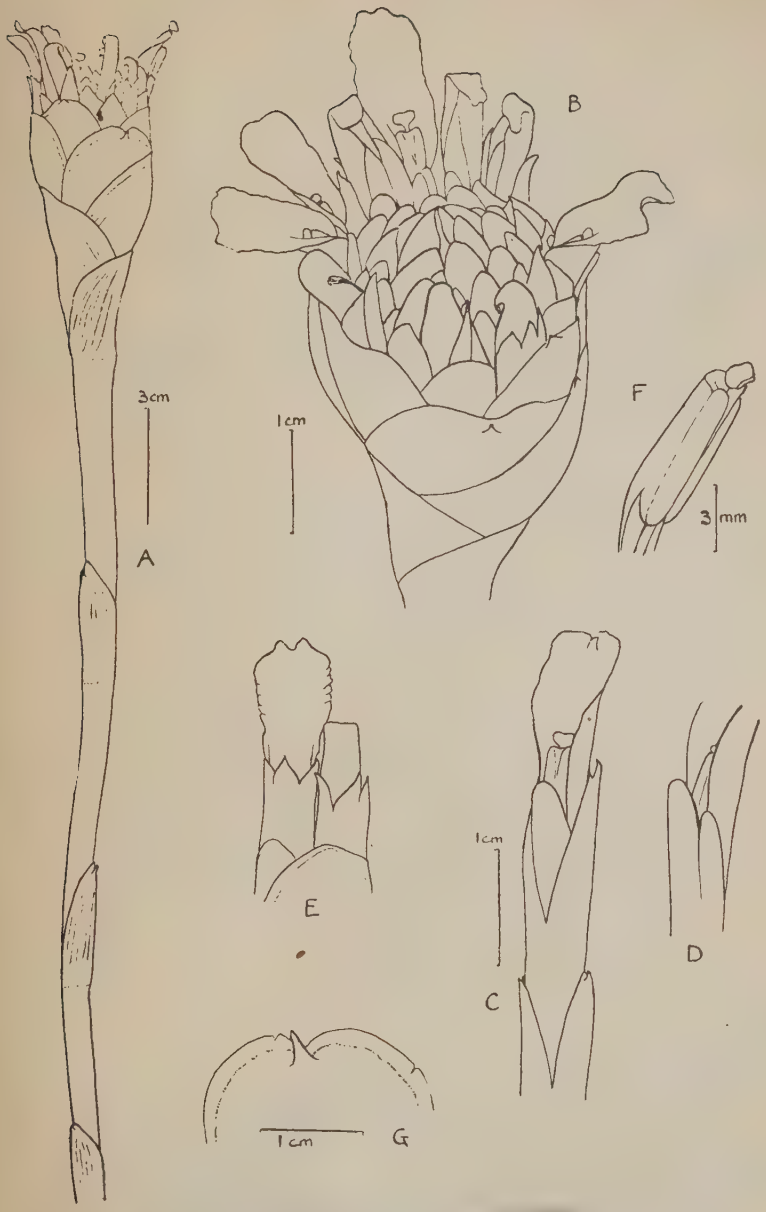

Fig. 21. *Phaeomeria Maingayi.* A, inflorescence and part of scape. B, oblique view of top of inflorescence. C, a flower, showing bilobed bracteole, split top of calyx, dorsal corolla-lobe (shorter than calyx) and lip. D, corolla-lobes and base of lip (calyx removed). E, on left an open flower (showing calyx and lower surface of lip), on right yesterday's flower with shrivelled lip. F, stamen and stigma. G, top of one of the larger involucral bracts.

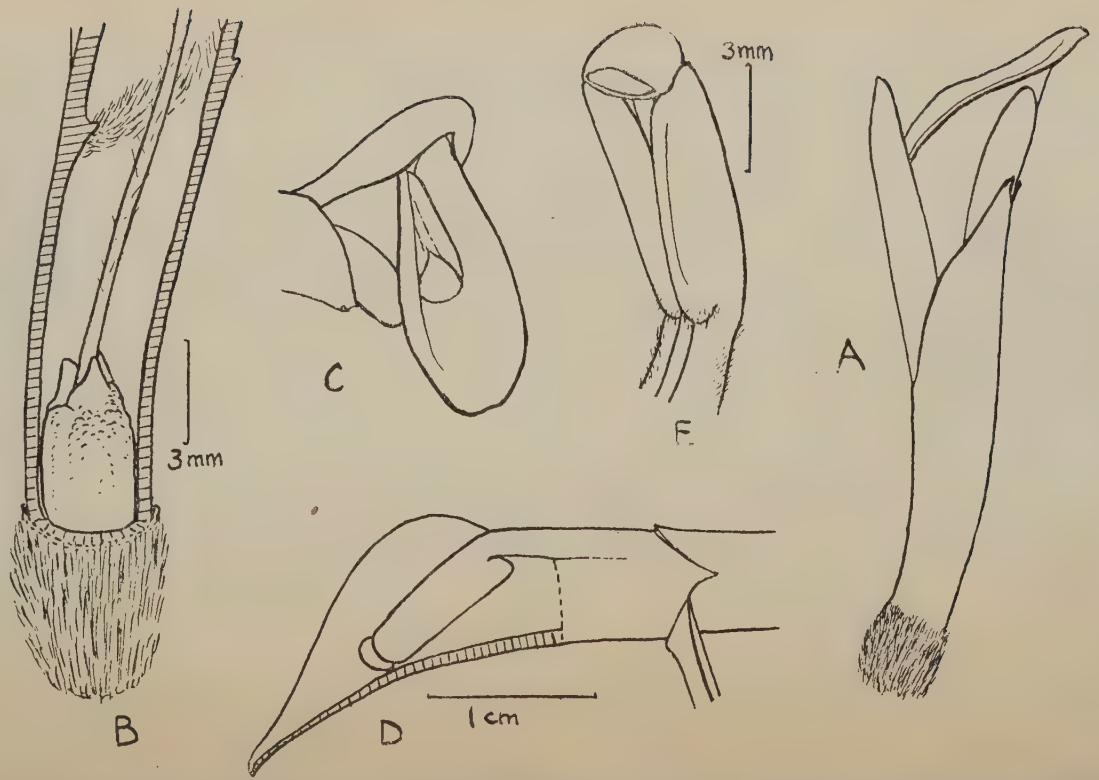

Fig. 22. *Phaeomeria fulgens.* A, a single flower, without bracteole. B, longitudinal section through base of flower, showing stylodes. C, mouth of flower. D, stamen and section of lip. E, anther and stigma.

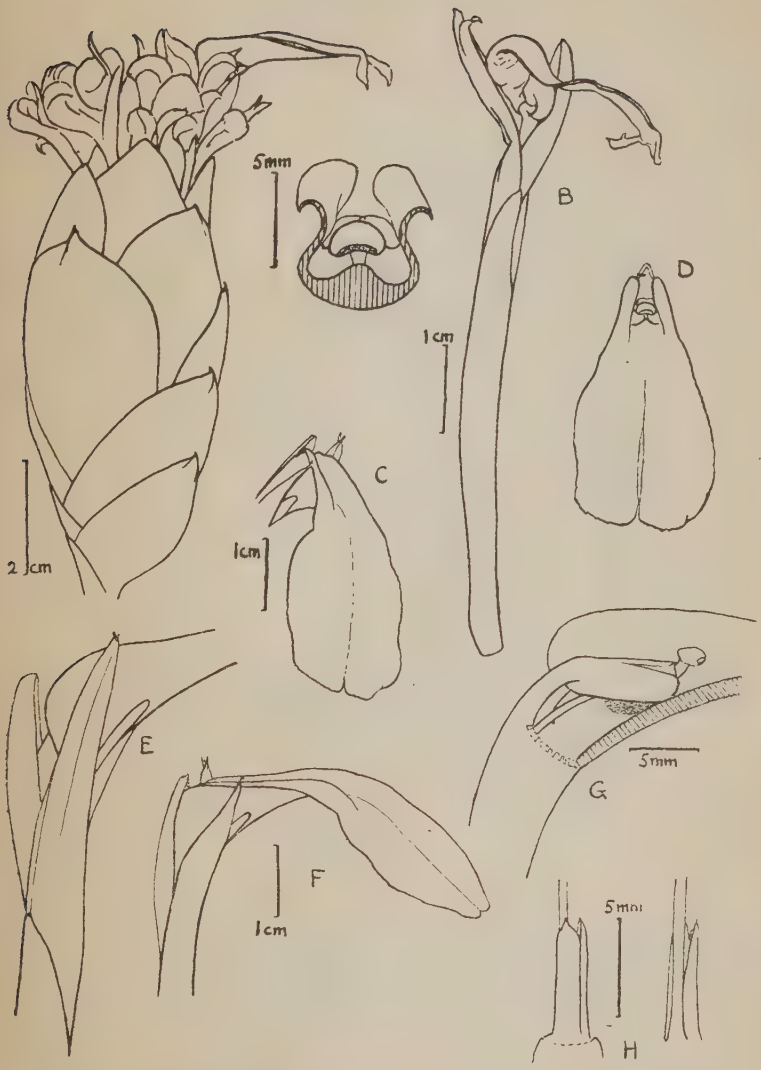

Fig. 23. *Achasma megalocheilos.* A, an old inflorescence, with many shrivelled flowers and one expanded. B, yesterday's flower, enclosed in its bracteole; calyx on left of shrivelled lip, corolla on right. C, top of open flower. D, view at 45 degrees to vertical, showing position of stigma in mouth of flower. E, bracteole, calyx (2 tips), corolla and base of lip. F, top of another flower, showing single tip of calyx on near side. G, stamen, style and stigma, with half of base of lip. H, two views of stylodes.

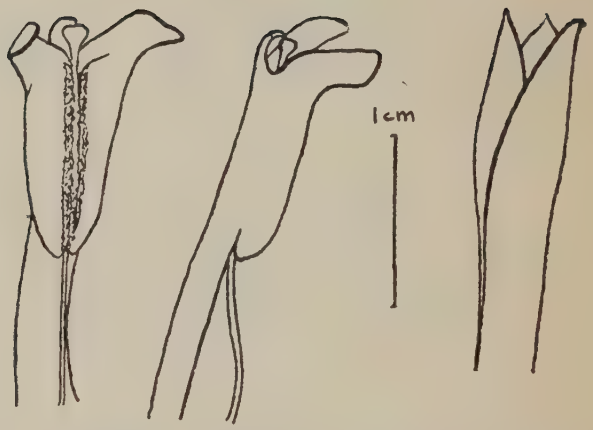

Fig. 24. *Amomum xanthophlebium*, two views of stamen, style and stigma; on right, a bracteole.

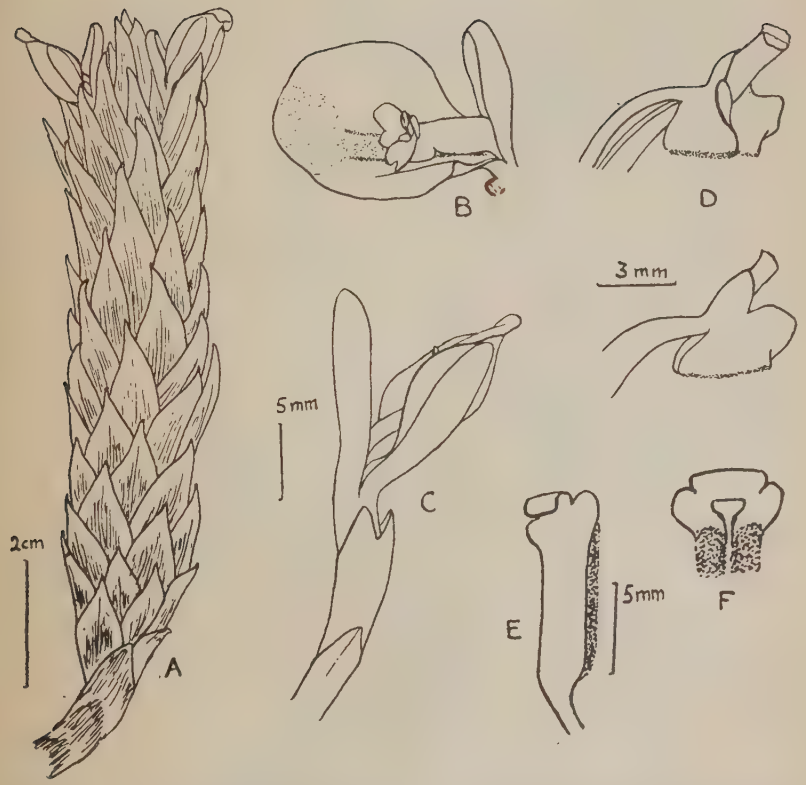

Fig. 25. A–D, *Amomum testaceum*. A, an old inflorescence with 2 flowers at top. B, flower from above. C, flower from side, showing bracteole at base. D, two views of stamen and stigma. E, F, *A. hastilabium*. E, stamen. F, anther-crest and stigma.

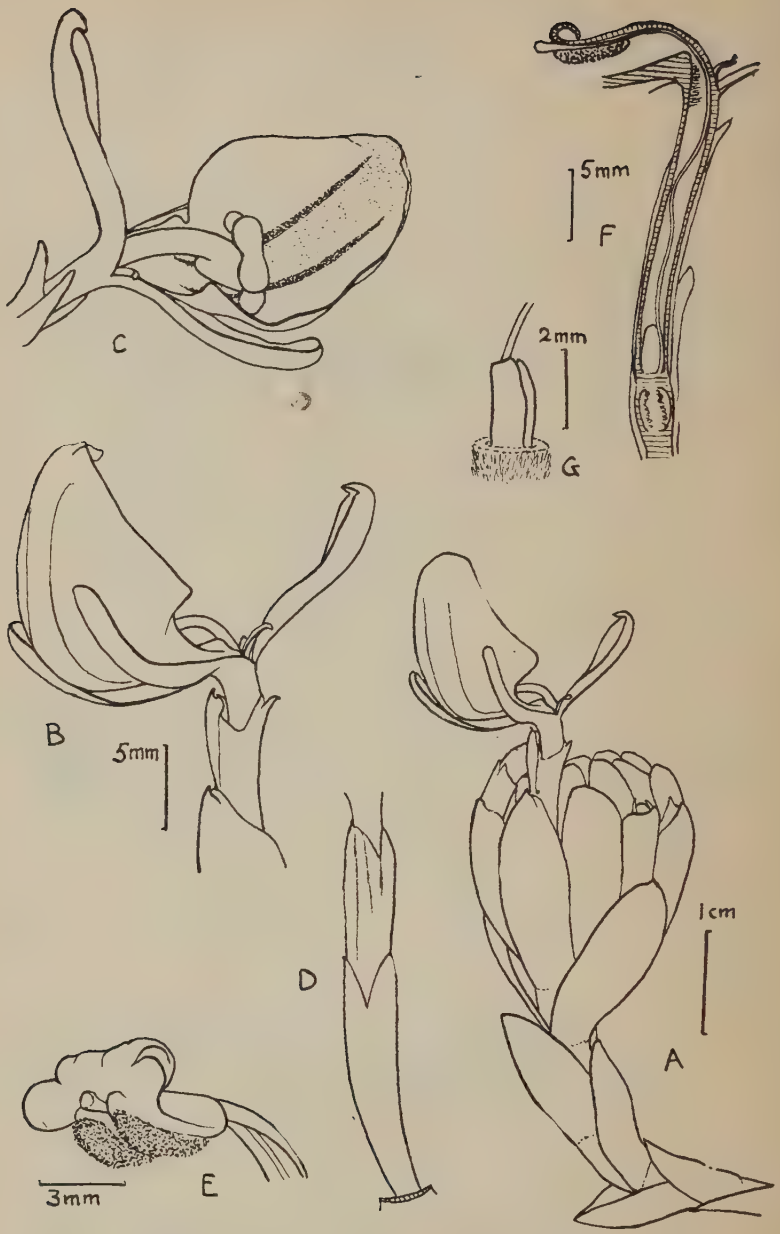

Fig. 26. *Amomum uliginosum.* A, inflorescence with one flower open. B, open flower and top of bract. C, view of flower from above, showing face of lip. D, bracteole, calyx and part of corolla-tube. E, stamen and stigma. F, longitudinal section through flower-tube and bracteole. G, stylodes, and base of style.

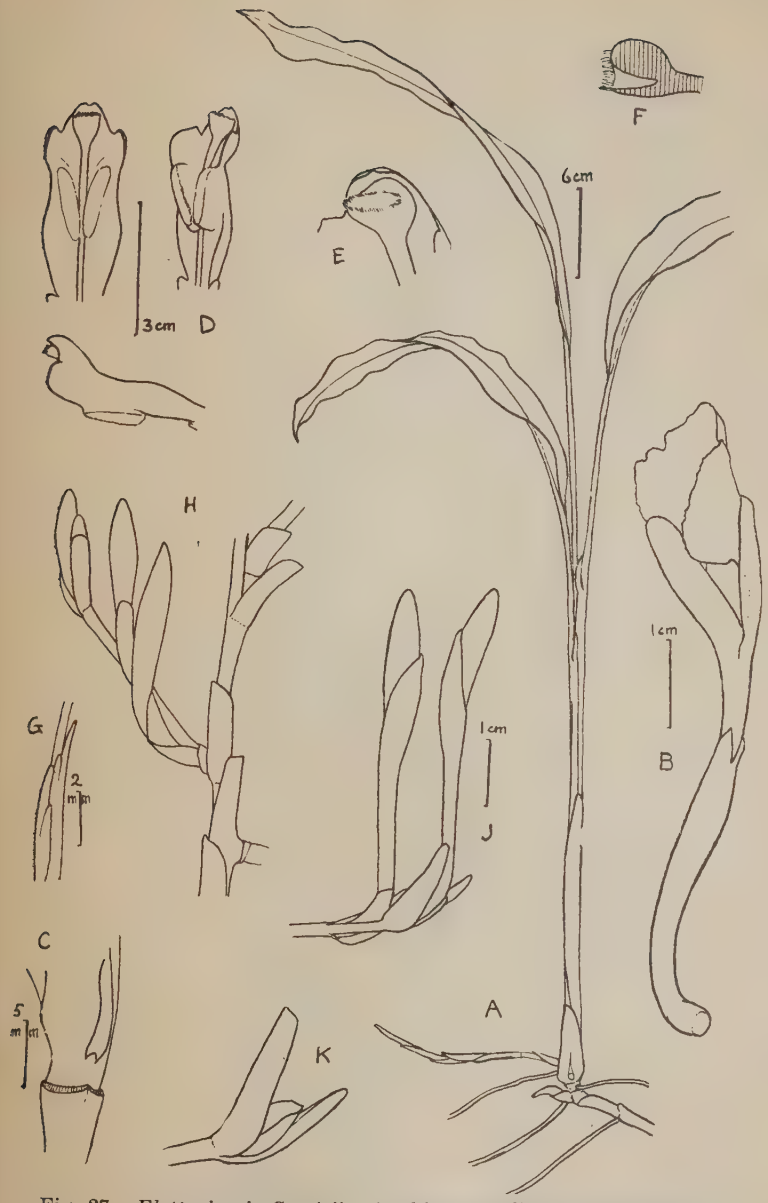

Fig. 27. *Elettariopsis Curtisii.* A, rhizome ending in a leafy shoot, with beginnings of two new rhizome-elements; inflorescence emerging from split basal sheath. B, a single flower. C, base of stamen and lip, showing a staminode; corolla-lobes removed. D, three views of anther, style and stigma. E, stigma. F, vertical section through stigma. G, stylodes and base of style. H, basal inflorescence-branch breaking through base of bract, and first flower of terminal inflorescence. J, last two buds on inflorescence. K, bract and bracteole of last flower, and end of inflorescence.

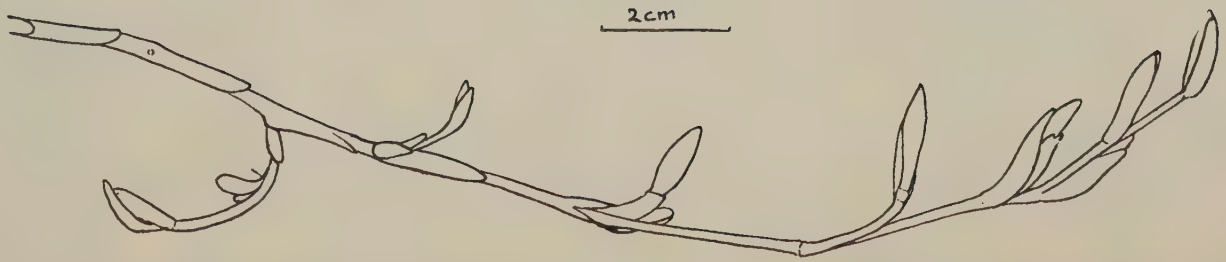

Fig. 28. *Elettariopsis Curtisii*, inflorescence, with two basal branches breaking through sheaths, rest with one flower-bud in axil of each bract; second bract removed, showing flower on its pedicel and bracteole at top of pedicel.

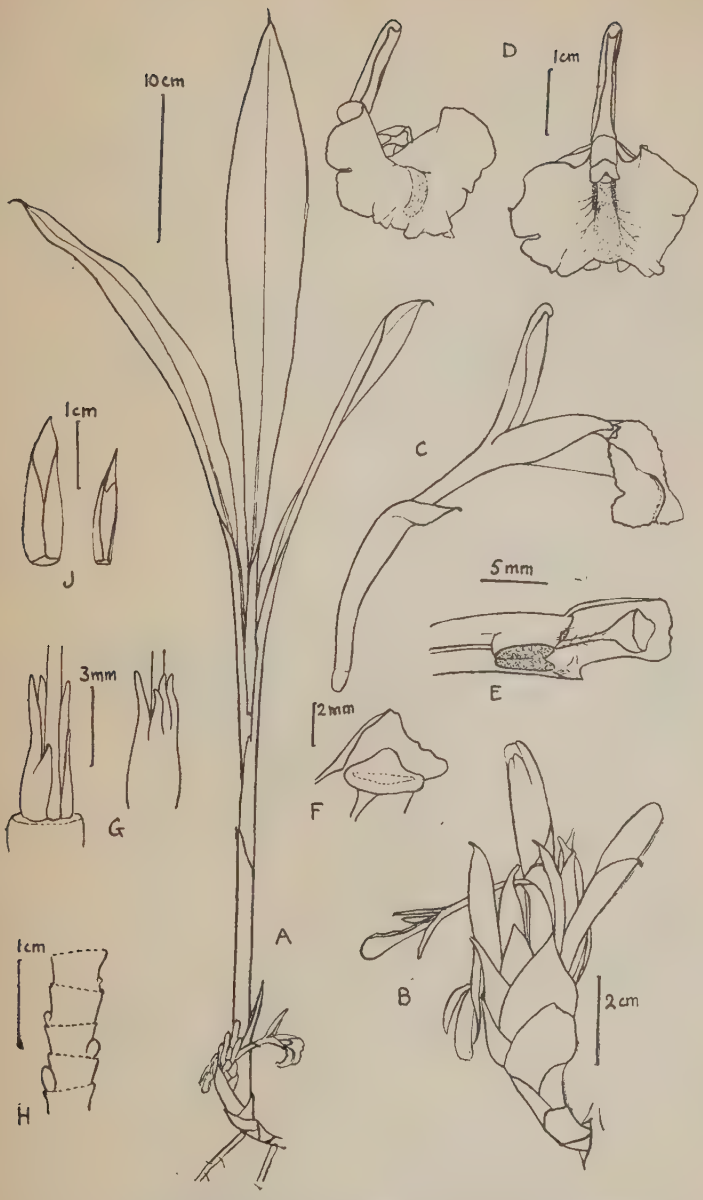

Fig. 29. *Elettariopsis triloba.* A, leafy shoot with inflorescence at its base. B, inflorescence with faded flowers and unopened buds. C, a complete flower (bracteole removed). D, two views of front of flower. E, stamen, style and stigma. F, stigma and top of anther-crest. G, two views of stylodes. H, scape of inflorescence, with bracts removed, showing buds which may form lateral inflorescences. J, one of the inner primary bracts, and a bracteole.

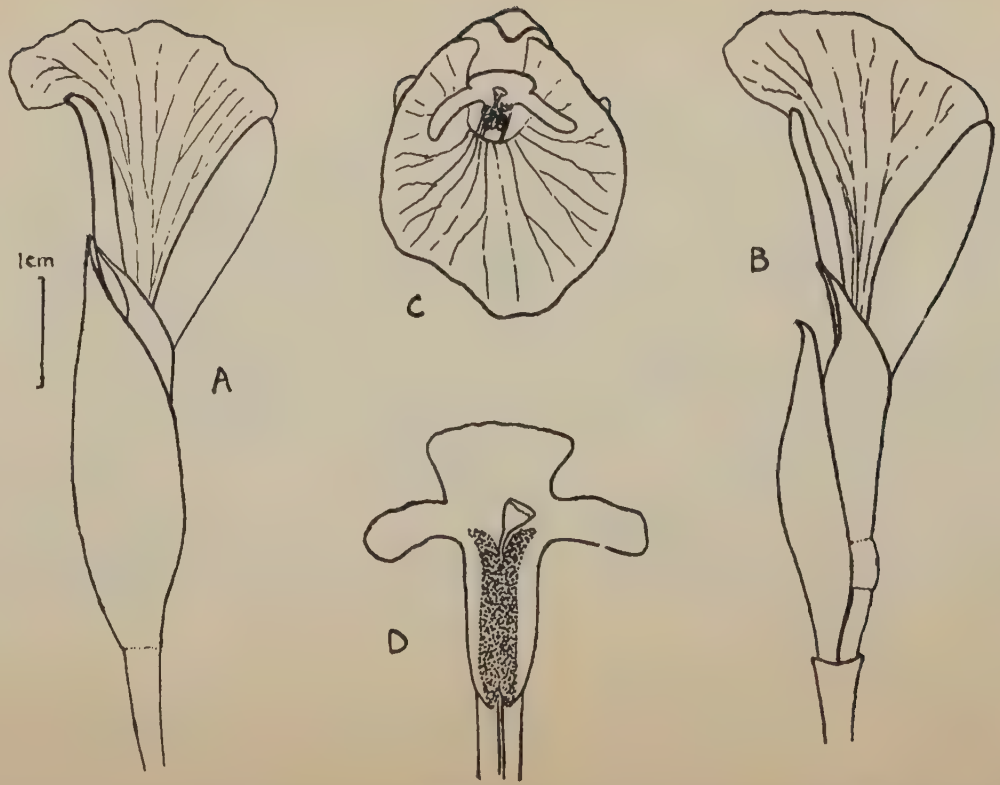

Fig. 30. *Geostachys densiflora*. A, a cincinnus with first flower open. B, the same with first bracteole removed, the flower now showing pedicel, ovary and calyx; second bracteole (enclosing rest of cincinnus) also showing. C, mouth of flower. D, stamen, style and stigma.

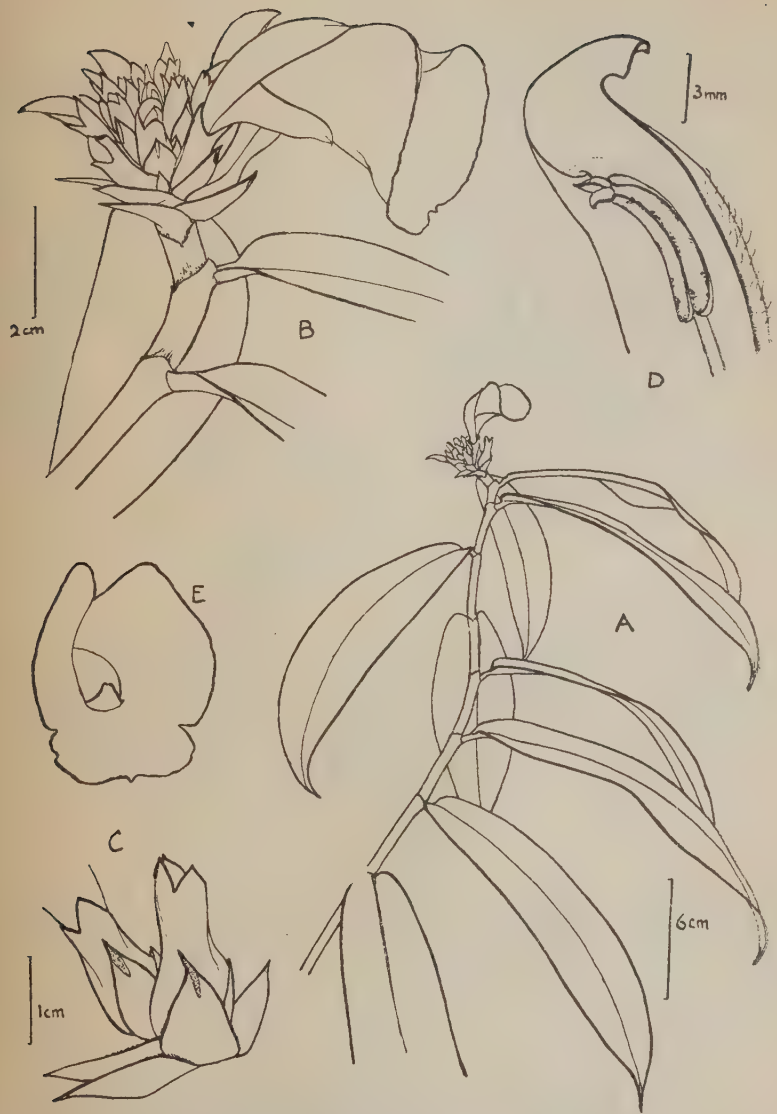

Fig. 31. *Costus speciosus*. A, top of flowering stem. B, inflorescence with one open flower, and base of upper leaves. C, bracts, bracteoles (lateral) and calyces of two flowers. D, lower surface of stamen with style and stigma. E, mouth of flower, showing stamen.

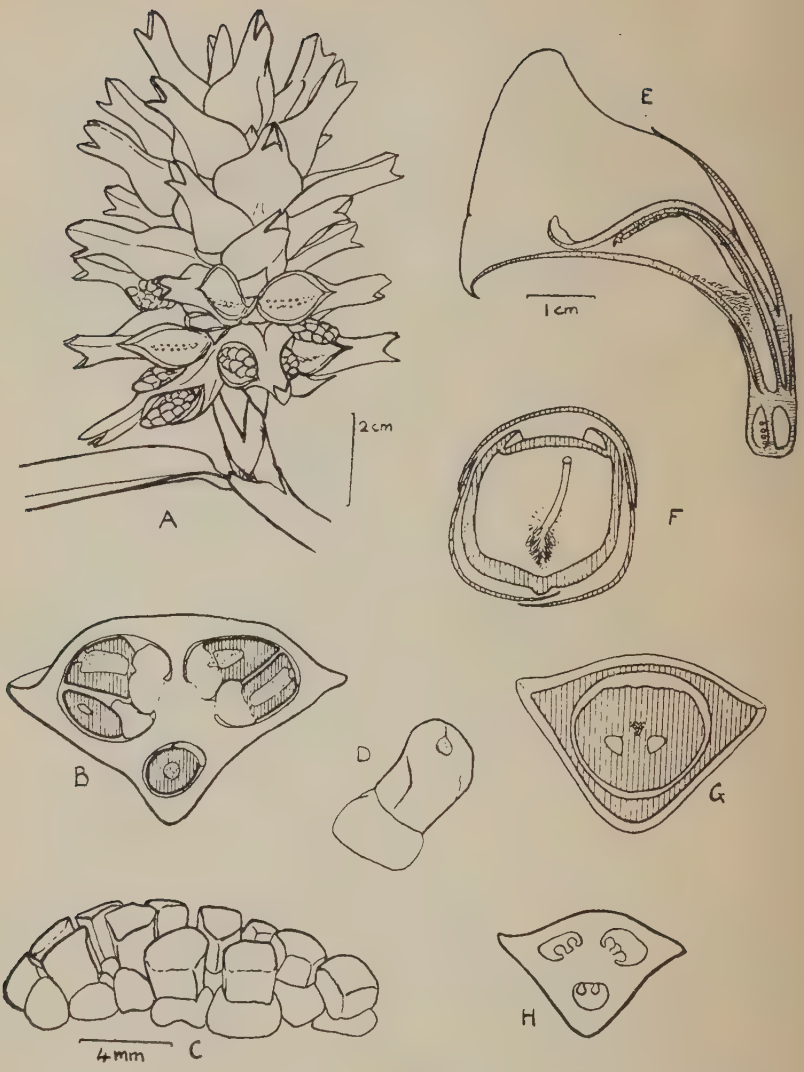

Fig. 32. *Costus speciosus.* A, fruiting inflorescence with lower fruits open. B, transverse section of fruit ready to open; endosperm cross-hatched, embryo dotted, aril blank. C, a group of seeds, each seated on its white aril. D, a single seed and its aril. E, longitudinal section of flower. F, transverse section of flower below junction of lip and stamen. G, transverse section of base of flower, showing calyx tube, nectar ducts in base of floral tube, and base of style. H, transverse section of ovary of a flower.

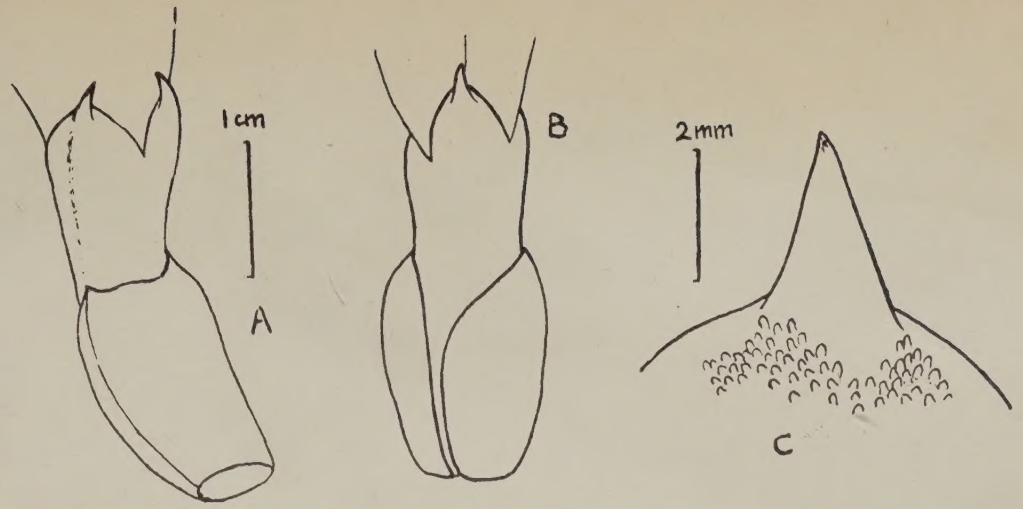

Fig. 33. *Costus globosus* var. *Ridleyi*. A, bracteole and calyx. B, same from other side. C, tip of calyx-lobe, showing unicellular hairs.

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3. **The Gardens' Bulletin, Straits Settlements.**
   - Vol. 1 nos. 1–5, January to May 1912 (as *Agricultural Bulletin of the Straits and F.M.S., Third Series*); nos. 6–12, December 1913—March 1917 (as *The Gardens' Bulletin, S.S.*).
   - Vol. 2 nos. 1–12, July 1918—August 1921.
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   - Vol. 6 nos. 1–15, (issued as parts 1–3) December 1929—October 1930.
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   - Vol. 11 parts 1–3, May 1939—August 1941.

4. **The Gardens' Bulletin, Singapore.**
   - Vol. 11 part 4, September 1947.
   - Vol. 12 part 1, April 1949.
   - Vol. 12 part 2, December 1949.

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24734—350—6/50